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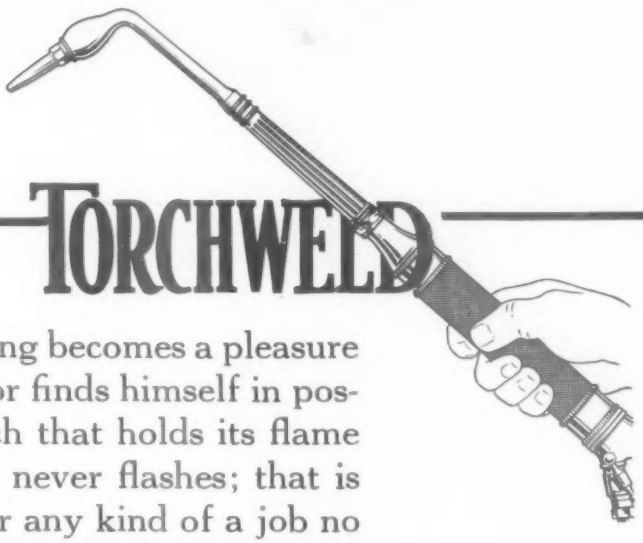

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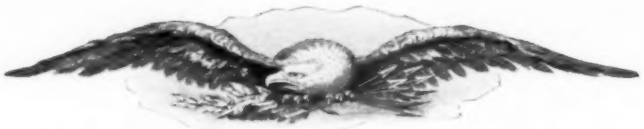

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Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Commercial Acetylene Welding Co.
Universal Oxygen Co.
Prest-O-Lite Co.

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Universal Oxygen Co.
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See "Torches"

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Superior Oxy-Acetylene Machine Co
Torchweld Equipment Co.
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See "Torches"

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A FEW OF THE 306

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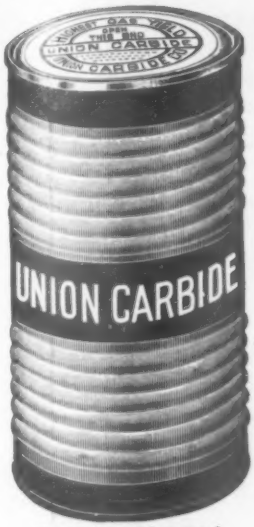

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Los Angeles—639 Gibbon St.
Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
San Francisco—Kohl Building.

COLORADO
Denver—Nineteenth and Wazee Sts.

CONNECTICUT
Hartford—412 Trumbull St.

DISTRICT OF COLUMBIA
Washington—Maryland Ave. and 9th St., S. W.

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Jacksonville—515 W. Bay St.
Tampa—107 Madison St.

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Savannah—Ogeechee Canal, South of Bay St., P. O. Box 78.

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Peoria—100-110 Edmund St.
Monmouth—124 E. Archer Ave.
Marion—315 S. Granite St., Box 747.
Quincy—222 S. Eighth St.
Springfield—217 S. 4th St.
Streator—501 East Hickory St.

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Fort Wayne—2216 Broadway.
Indianapolis—110-112 S. Alabama St.
Terre Haute—921 Wabash Ave.

IOWA
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Des Moines—3rd and Elm Sts.
Dubuque—8th and Washington Sts.
Fort Dodge—10 S. 8th St.
Ottumwa—207-9-11 S. Washington St.
Sioux City—925 Fourth St., P. O. Box 398.
Waterloo—1209 E. 4th St.

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Salina—154 So. 5th St.
Wichita—535-543 West Douglas Ave.

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Middlesboro—1701 Cumberland Ave.

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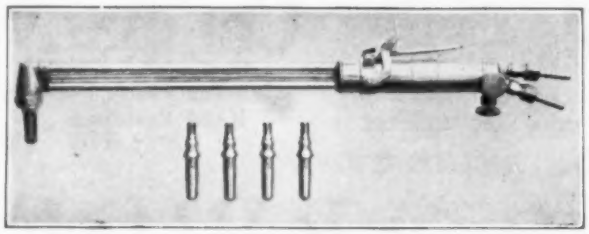

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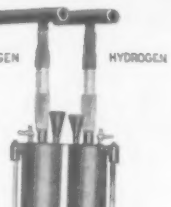

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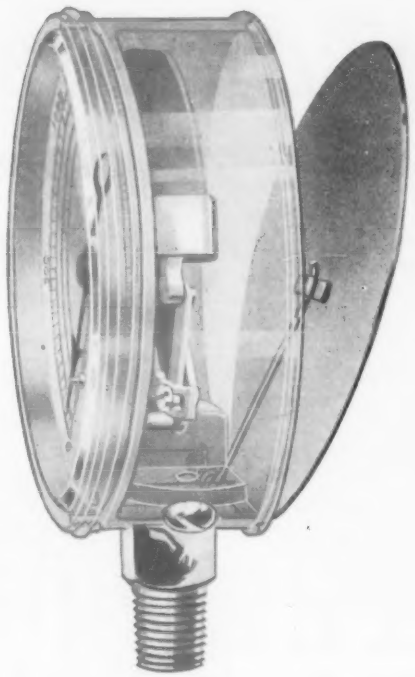

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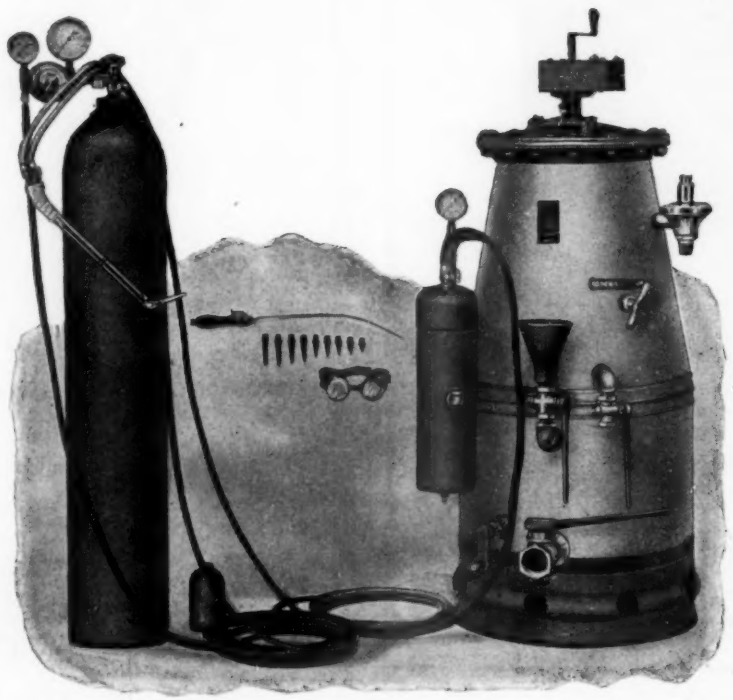

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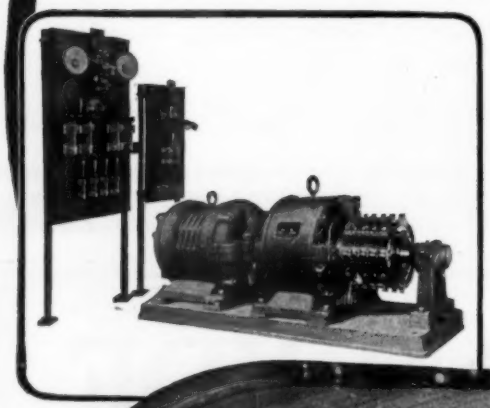

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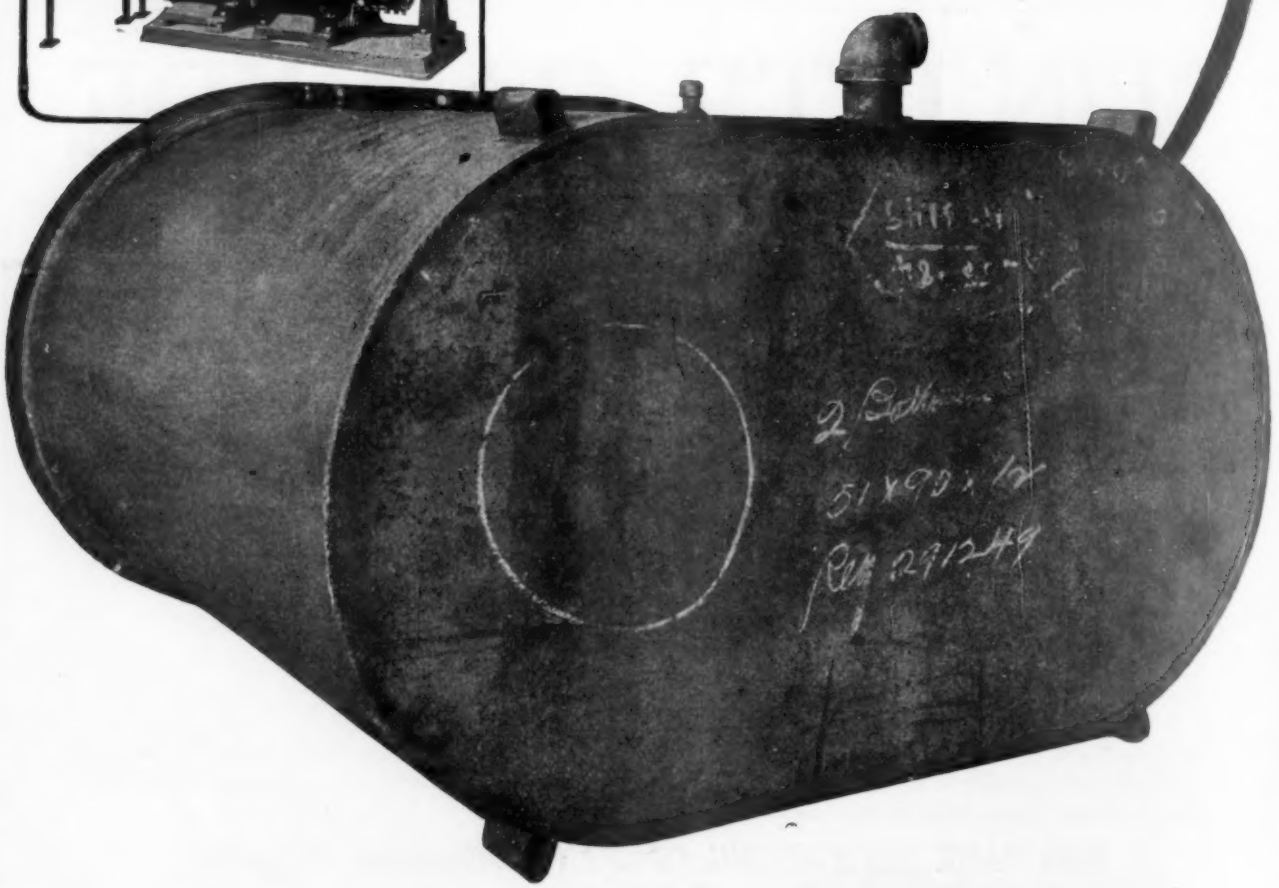

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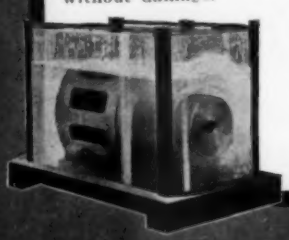

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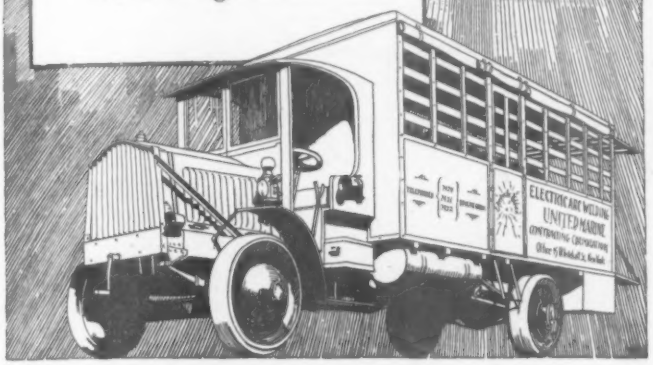

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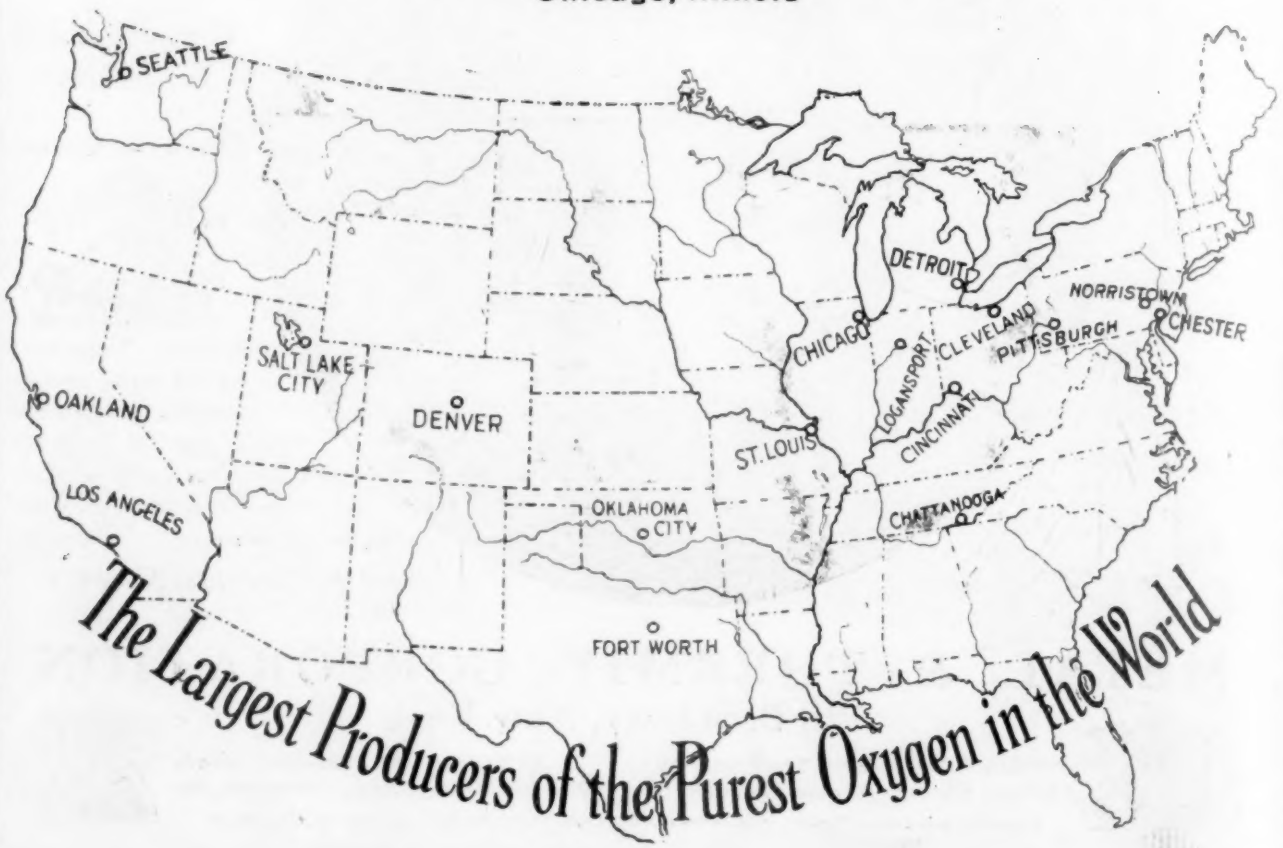

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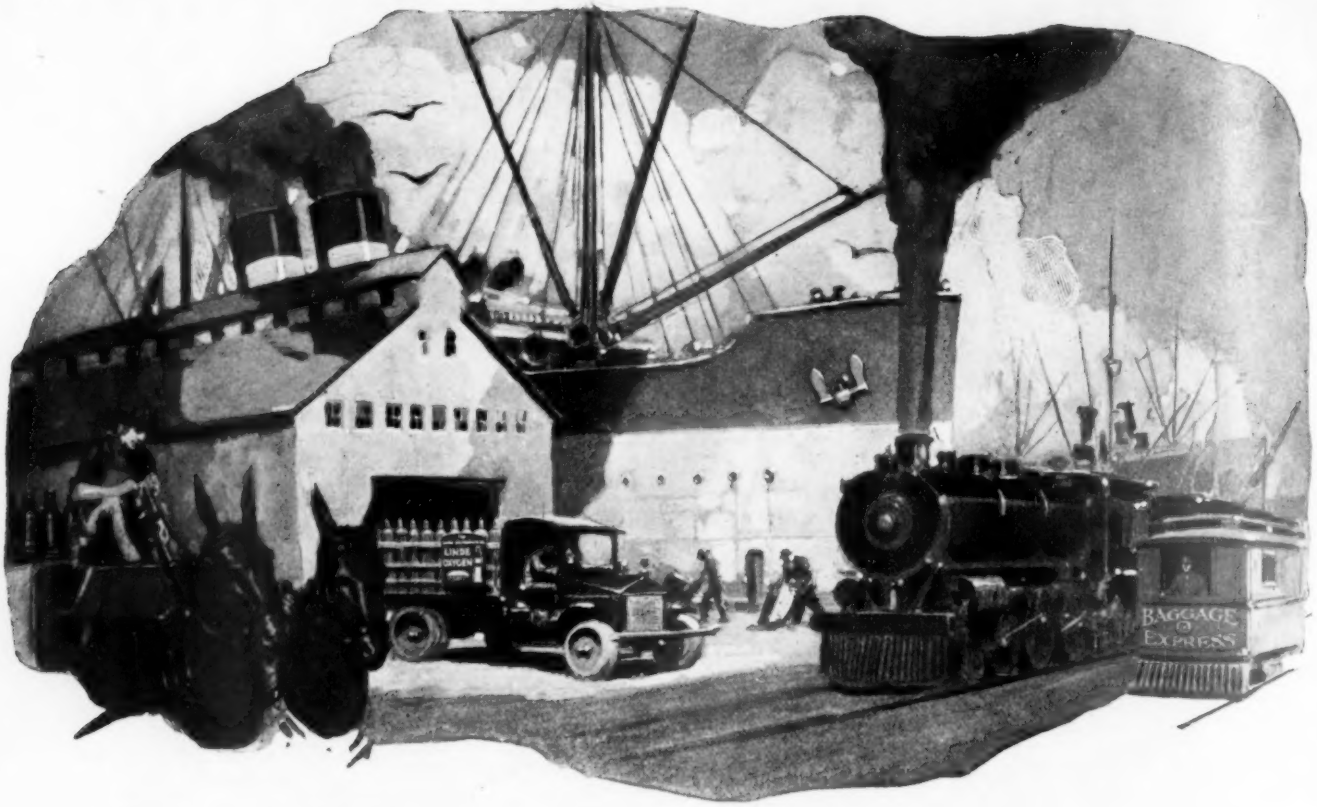

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METALLOGRAPHY OF IRON AND STEEL WITH REFERENCE TO OXYGEN CUTTING

By F. J. Napolitan

From the ease with which wrought iron is cut, we may conclude that an aggregate of ferrite combines with oxygen with greatest avidity, and permits the propagation of a cut with least interruption. As the carbon content is increased, there is a material change in the nature of the metal. In place of the preponderance of ferrite grains, we recognize the formation of cementite, and its union with some of the ferrite to form pearlite—the original mass of pro-eutectoid ferrite rapidly diminishing in prominence. As we should anticipate from the nature of pearlite, no material change is noticed in the performance of these alloys under the cutting torch. Of course, an ultraprecise consumption test would probably indicate a lowering of the efficiency coefficient, but, from all appearances, no unusual difficulty is experienced in cutting carbon steels up to about 80 to 90 points carbon. But here, a definite transition is indicated by a distinct laboring of the cutting torch. While the torch will begin a cut with practically the same effort, and proceeds to completion without interruption or unusual delay, yet the kerf is wide and ragged and undeniably distinguished from that of a mild steel cut. It is recognized practice, now, to preheat the piece to be cut to a black or dull red heat, when the impediment, whatever it was, seems to have been entirely eliminated.

But let metallography explain the sudden change of properties of the steel. As the carbon content of the hypo-eutectic steel was increased, the proximate mass of pearlite increased, and the pro-eutectoid ferrite correspondingly diminished in volume, until eventually, a point was reached where all of the cementite and ferrite existed in the stratified or laminated relationship of pearlite. This state is recognized as existing where the carbon content is between 80 and 90 point—the approximate analysis of pearlite is yet undefined. As the carbon content is further increased, there appears a constituent that we know as pro-eutectoid cementite—in fancy, the cementite which has been ejected from the pearlite growth. It is circumstantial that the presence of this pro-eutectoid cementite is directly responsible for the increasing difficulty of our cutting. But why did preheating of the steel before cutting make such a remarkable difference in the results. To be sure, the rise in temperature might affect the stability of any martensite, troostite, or even sorbite that might have existed, but the temperature was too far removed from the Ac 3-2-1 point to affect the characteristics of the pearlite. And surely the pro-eutectoid cementite was unchanged—and it was this same constituent that we blamed for the difficulty.

Again, as the carbon content is substantially increased, an equivalent interference with cutting is apparent, until, when the carbon content approaches 2.5 per cent, cutting becomes so labored as practically to cease, and no amount of preheating short of incipient fusion will permit it to propagate. As you are aware, the metal is now termed "cast iron," and a micro-analysis indicates that in addition to the presence of a certain amount of pearlite and pro-eutectoid cementite, as well as certain foreign and to our discussion, unobtrusive substances, we recognize the presence of the final and most stable state of carbon-graphite. The pearlite constituent exercises a favorable influence upon the operation of cutting and the pre-eutectoid cementite, while it impedes cutting, is readily compensated by a slight preheating—but the graphite presents an entirely new problem.

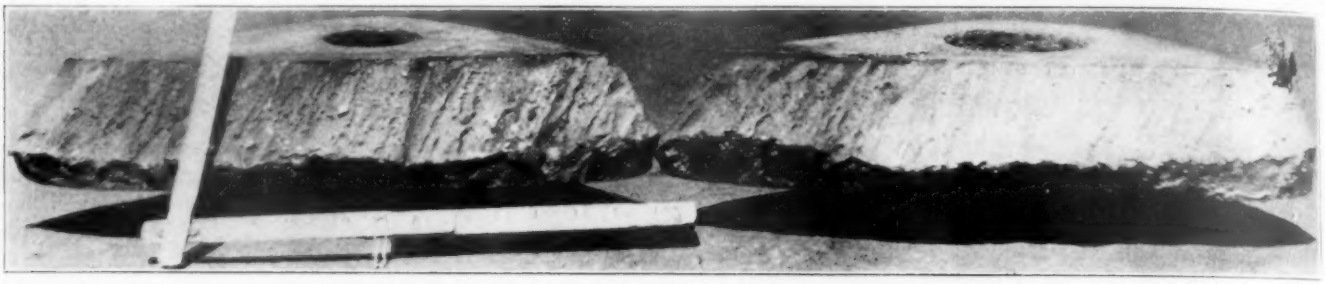
We might digress from the subject enough to present some remarks that would prove the fallacy of at least one of the stereotyped explanations of why cast iron cannot be cut—that the melting point of the slag is appreciably higher than the melting point of cast iron. A micro-analysis of the structure of an average cast iron—and by average we refer to a gray cast iron of about 3 to 4 per cent carbon—would indicate a structure identical with that of a hypothetical steel of the same carbon content, except that some of the carbon seems to have been precipitated as graphite. But should that identical pour of cast iron have been cast against a cold iron mold, or otherwise chilled, the carbon would not have been precipitated as graphite and we should have had what we shall call a "chilled cast iron," or a "white cast iron," and it would actually have been a hyper-eutectic steel. Such alloys are not uncommon in commerce, and the fact that operators have been able to cut them with no extraordinary effort has been responsible for innumerable false claims that cast iron has been cut. Unfortunately, the nomenclature of steels and irons is not clearly defined, and undoubtedly, a chilled cast iron is but an extension of the hyper-eutectic series. The melting point of an iron-carbon alloy is a constant of its composition, whether, in the solid state, the metal exists as a typical cast iron or as a steel. Long before the point of fusion, the carbon and iron exist in one relationship, that of austenite. The conditions affecting the pouring of a melt of cast iron would determine the final state of its constituents,—and we might as readily produce a gray cast iron or a chilled white cast iron—the carbon as graphite or the carbon as in cementite. In either event, the melting points of the resulting products would be identical. We agree that

chilled cast iron can be cut with comparative ease, notwithstanding that its melting point is lower than the melting point of the slag produced. It is evident, then, that the melting point of slag is not responsible for the difficulty encountered in cutting cast iron.

We had concluded that while the existence of pro-eutectoid cementite appreciably retarded cutting, the presence of but a comparatively small amount of graphite completely prevented cutting. The phenomenon, if it were true, is unique for it would presuppose the incombustibility of carbon. Science contradicts us immediately. In fact, our own welding practice belies us. We might point to the reaction accompanying the removal of carbon from automotive cylinders by the oxygen method—or, leaving our immediate field, we might mention the explosive combustion of carbon in ordinary gunpowder. We are forced to conclude then, that far from retarding the combustion of the steel matrix, the graphite of cast iron should actually assist it.

We investigated further to determine how much graphite influenced cutting. We obtained specimens of so-called malleable castings of the characteristic "black heart" structure. Such a structure is made in this country by the annealing of white cast iron in which all of the carbon exists in cementite or pearlite, the latter in some cases entirely removed. The treatment decomposes the cementite to precipitate the carbon in minute particles, differing from the graphite of gray cast iron in their extreme subdivision and uniform distribution throughout a ferrite matrix. In making a black heart casting, an oxidizing packing is used in this country so that while the core is that of a black heart casting, the mass near to the surface is ferrite. We removed this shell of ferrite so that our materials indicated, under the microscope, a uniform aggregate of ferrite and temper carbon. By preheating this piece to a dull red heat, it was cut with the characteristics of a high carbon steel. Then we were satisfied that carbon as such did not prevent cutting, but that the physical state of that carbon was responsible. As plates of graphite, cutting was prevented—but as finely divided particles, cutting was scarcely impeded.

Reconsidering our previous observations in the light of this development, we began to substantiate our first logical hypothesis. We found, to summarize, that ferrite permitted most readily to be cut. Pearlite with pro-eutectoid ferrite did not materially affect the conditions. A completely eutectic composition first suggested a transitory stage. The existence of pro-eutectoid cementite retarded cutting, but preheating of the piece to a red heat readjusted the conditions so that cutting was again as efficient as in the case of ferrite. As the comparatively low temperature produced by preheating was insufficient to affect any change in the physical state of the constituents of the alloy, we were forced to conclude that the addition of heat units affected a definite constant, which we assumed was the heat of combustion of the iron, as the two forces were of like characteristics. Then a constant result from a variable made axiomatic the existence of a second variable. Our second variable, then, we concluded was the cooling effect of the stream of cutting oxygen, and a further thought suggested a third variable in the time of chemical reaction between the iron and oxygen. The preheating flames ignited the steel—the cutting oxygen produced combustion—and the propagation of the cut was the natural consequence. But as the carbon content was increased the speed of the reaction was materially lowered. However, the velocity of cutting oxygen to insure a continuity of oxygen and slag to the bottom of the cut, was a constant. Then, eventually, a point was reached where the rate of combustion between the iron and oxygen was so slow that the heat units liberated from the reaction were dissipated to such an extent as no longer to ignite adjacent masses of metal—and cutting ceased. By preheating the piece before cutting we add to the forces on



The attached two photographs were taken in the Davis-Bournonville Welding Shops at the company's factory in Jersey City, in June, 1919, illustrating a practical job of cutting four corners of a large cast iron stone crusher head with the oxy-acetylene torch. The cuts were beveled, in preparation for welding. Customary chipping methods would have required several hours, but the cuts were made with the torch in less than one hour. Each piece represents a cut 4½ in. thick, 17 in. long, an area of 76 sq. in. The cuts were made in 6½ minutes each, using 24 cu. ft. of oxygen and about 4 cu. ft. of acetylene. The kerf was about 5/16 in. wide at both top and bottom, the edges sharply defined, the total result approximating similar cutting of cast steel. When the cuts were started they were completed without stopping, and the pieces dropped apart of their own weight.

the weakening side of the equilibrium, and cutting once more obtained. The heat units so obtained compensated for the relatively less heat units liberated from the chemical combination of the iron and oxygen in a definite unit of time.

From the existence of pro-eutectoid cementite there emerges tempering carbon and ultimately graphitic carbon. While the pearlite and pro-eutectoid cementite are readily compensated, the graphitic carbon effectively prevents cutting by the ordinary means. No addition of heat units short of incipient fashion, by preheating the object, restores the equilibrium. We cannot strengthen further, one side of our equilibrium, but we have not attempted to affect the other side. We have made no attempt to reduce the cooling effect of the cutting oxygen. We therefore experimented in this direction, and found that we could so effectively preheat the cutting oxygen that we could restore the equilibrium without preheating the object.

RECENT DEVELOPMENTS IN OXYGEN CUTTING*

By Stuart Plumley and F. J. Napolitan†

A few days ago we were requested by the American Welding Society to prepare a paper setting forth the most recent developments in the art of cutting with oxygen. In considering this subject from a broad standpoint we have concluded that the most interesting development which has occurred recently in connection with cutting is, without doubt, the successful cutting of cast iron.

More than a year or two ago there were rumors, heard now and then in the industry, of some genius who stated that he had cut, or could cut cast iron. These rumors were not given much credence because it was thought that in most instances the man who believed he had cut cast iron, had in reality cut something else which he thought was cast iron.

About the same time the Engineering Department of the Davis-Bournonville Company began to think more deeply cast iron. We begantaointaoin0fl iwwwtaoni aoin aoinlu upon the subject, with a view to learning more of the basic principles underlying cutting, particularly with respect to cast iron. We began to experiment about that time and detailed our Mr. F. J. Napolitan to the work. Mr. Napolitan has continued his efforts in this direction until we believe he has developed some very interesting theories, and has evolved some principles which are of extreme importance to the art. In compiling this paper, Mr. Napolitan and I have worked together to lay before the Society an outline of these theories and principles, which we believe will be of interest, and which may explain some of the conditions well known by men practiced in cutting, but which had never been clearly understood by the majority of cutters.

When we succeeded in cutting cast iron, it much disturbed our dignity in that we were obliged to reverse our former opinions and beliefs, and to take back the statement often made, that cast iron could not be cut with the oxy-acetylene torch. Unfortunately, our experiments are by no means concluded, so that we are not free to disclose all that we would desire. Frankly, our investigation of cast iron cutting was inspired by nothing more noble than to seek a better explanation of why cast iron could not be cut. Most of us, and I am no exception, have expressed at some time or other in our experience, the solemn opinion that cast iron could not be cut, because the oxide of iron melted at a temperature higher than cast iron itself. Not only does cast iron burn to form an oxide, but the higher melting point of the oxide probably assists the reaction.

†Engineering Dept., Davis-Bournonville Co.
*Paper read before the first annual meeting of the American Welding Society, April 22, 1920.

While we are rather skeptical of the commercial value of a cast iron cutting torch and are convinced that financially we will never be repaid for the expense of our experiments, yet there are undoubtedly, occasions when the cutting of cast iron would be of great value. In the ordinary scrap-yard or in instances where the cutting process would be used as with steel, it is so easy to break cast iron, that it would hardly be economic to use the cutting torch. Were we not to further develop cast iron cutting, however, we should feel remiss in the work of our Engineering and Research Department.

You are all aware, of course, of that application of oxygen cutting used largely in blast furnace practice the opening of a "frozen" tap hole. You could not quite reconcile this more or less common application of the process with the pet theory that cast iron could not be cut.

One of the usual methods for releasing a frozen tap hole in a blast furnace is substantially as follows. A piece of ¼ inch iron pipe with a brass handle, at least ten feet long is attached to a manifold of several oxygen cylinders. Oxygen is delivered through this pipe at a pressure of approximately 100 lbs. per square inch. A hole is started with a star drill or diamond point until it is about 3 inches deep. The metal adjacent to the hole is heated with a fuel oil burner or by other means. The end of the iron pipe is ignited and the composite stream of molten iron slag and oxygen caused to impinge against the frozen cast iron.

A spectator to this performance of infernal fury is readily convinced that the heat is not all due to the combustion of the wrought iron pipe but that the cast iron is burning with a violence equal to that of steel. This reaction inspired some inventors to incorporate a device in an oxy-acetylene torch for cast iron cutting which would feed a steel wire between the cutting jet and the cast iron piece being cut. Ignition of the wire carried a stream of molten slag on to the cast iron and it was hoped thus to propagate the cut. In a second process a plate of steel of a definite and predetermined thickness was placed on top of the cast iron. It was hoped that the slag incidental to the oxidation of the steel would exercise some influence over the cast iron and enable it to be cut.

Unfortunately for those responsible for the exploitation of these devices, the inventors were more concerned with converting cast iron into iron oxide by means of the oxy-acetylene torch than they were in constructing a practical process and a practical tool. It was next proposed to simplify the reaction by supplying an apparatus with a mixture of pulverized slag and iron powder and in fact a number of patents were issued covering various applications of such a device. Crude and elementary as such devices were they actually produced combustion of the cast iron and went a long way in stimulating us in our endeavors to find a successful method.

Experimental work was continued with a torch having a good many different tubes leading to the head so that almost any combination of gases at varied pressures might be obtained. Mr. Napolitan has evolved from these experiments, interesting theories pertaining to the reaction which take place in cutting together with their relation to our success in cutting cast iron. He has noted these theories in a separate paper which is attached herewith. We are presenting these theories to the members of the Society for what they are worth. We can actually cut cast iron and we do it by PREHEATING THE OXYGEN. We have endeavored to tell in these papers our conclusions pertaining to the reactions which take place. As the metallography of iron and steel, with reference to cutting, is at best difficult and laborious reading, we do not propose to bore you with it tonight, but

attach the paper pertaining particularly to this phase of the subject for those who are sufficiently interested. If there are any statements herewith which are not clearly understood or if the theories need further explanation we will be very glad to answer any questions pertaining to them which may be addressed by letter to the Engineering Department of the company.

AUTOMATIC ELECTRIC ARC WELDING MACHINE*

By H. L. Unland†

The automatic arc welder is a device for automatically feeding the metallic electrode wire into the welding arc at the rate required to hold a constant arc length. Under these conditions the electrical conditions are kept constant and the resulting weld is uniform and its quality is thereby improved. It is possible with this device to weld at a speed of from two to six times the rate possible by skilled operators welding by hand. This is partly due to the stability of the welding conditions and partly due to the fact that the electrode is fed from a continuous reel, thus eliminating the changing of electrodes. The automatic welder is adaptable to practically any form of weld from butt welding of plates to the depositing of metal on worn surfaces such as shafts, wheels, etc.

Everyone who has made any investigation of electric arc welding has noted the wide variation in results obtained by different welders operating, as nearly as can be determined, under identical conditions. This also applies to the operations of a single welder at different times under identical conditions. These variations affect practically all factors of welding such as speed of welding, amount of electrode consumed, etc. When indicating instruments are connected to an electric welding circuit, continual variations of considerable magnitude in the current and voltage of the arc are at once noticed. This same condition was found some years ago in the cutting of steel plates by the gas process and when an equipment was devised to mechanically travel the cutting torch over the plate a series of tests to determine the maximum economical speed, gas pressure, etc., for the various thicknesses of plate were made. The result was that the speed of cutting was increased to as much as four or five times the rate possible when operating under the unsteady conditions incident to hand manipulation of the torch. Further, the gas consumption for a given cut was found to be decreased very greatly.

As a result of these experiences an investigation was started to determine what could be done in controlling the feed of the electrode to the electric arc in a metallic electrode welding circuit. An electric arc is inherently unstable, the fluctuations taking place with extreme rapidity. In any regulating device the sensitiveness depends on the percentage of variation from normal rather than on the actual magnitude of the values, since these are always reduced to approximately a common factor by the use of shunts, current transformers, or series resistances. The characteristics of practically all electric welding circuits are such that the current and voltage are inter-related, an increase in one causing a corresponding decrease in the other. Where this is the case it will generally be found that the percentage variation of the voltage from normal when taken at the customary arc voltage of 20, will be approximately twice the percentage variation in current. Further, an increase in arc voltage, other conditions remaining the same, indicates that the arc has been lengthened, thus giving the metal a greater opportunity to oxidize in passing through the arc with the probability of reduction in the quality of the weld. The automatic welder utilizes the arc voltage as the basis for regulating the equip-

Fig. 2. Motor Shaft Journals Built Up by Automatic Arc Welding Machine.

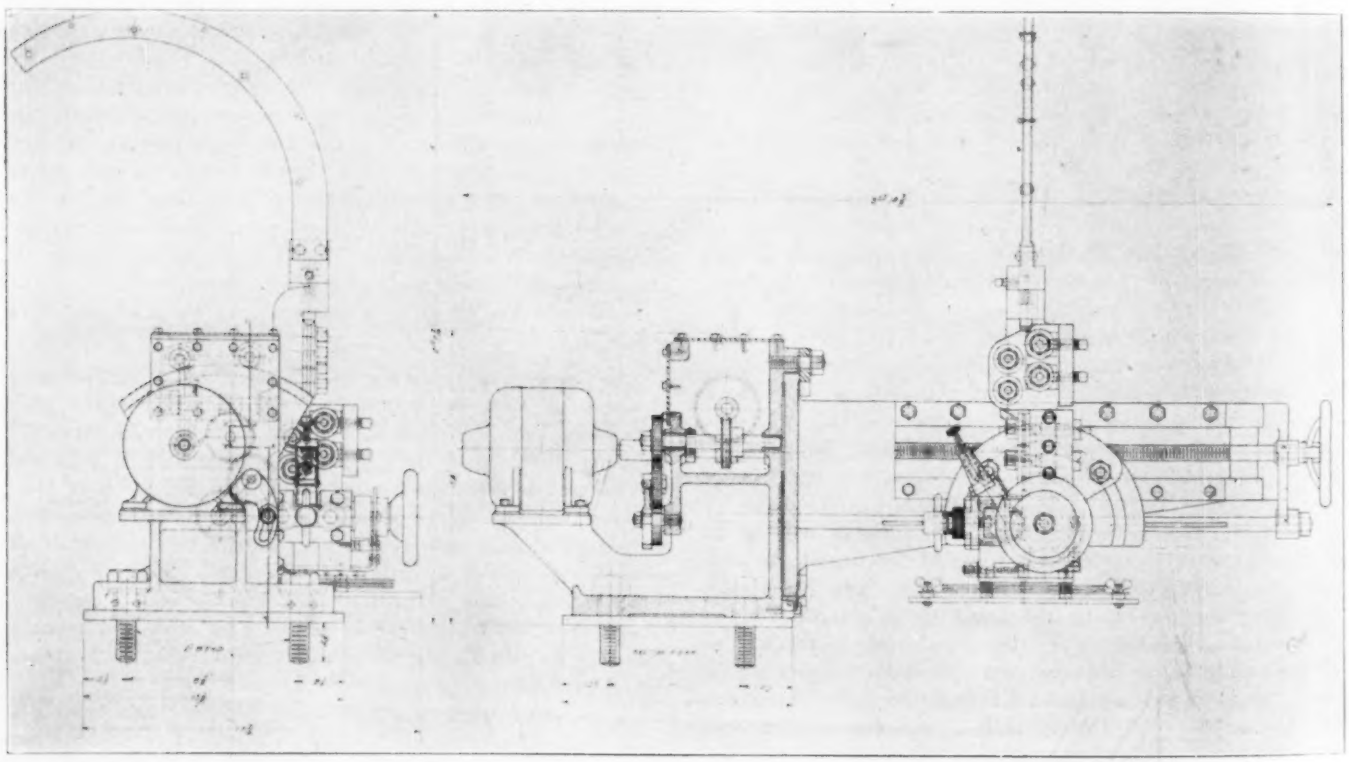


Fig. 1. Assembly of Automatic Arc Welding Machine.

*From a paper read before the American Welding Society.
†Power and Mining Dept., General Electric Co.

ment. The rate of feeding the wire varies over a wide range due to the use of electrodes of different diameters, the use of different current values, etc., caused by details of the particular weld to be made. The simplest and most reliable method of electrically obtaining variations in speed is by means of a separately excited direct current motor. Thus the operation

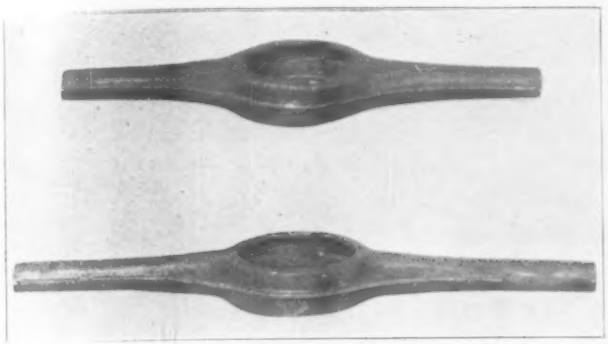


Fig. 3. Automobile Rear Axle Housings Welded by Bare Electrode Metallic Arc.

of this equipment is limited to direct current arc welding circuits but these may be of any established type, the variations in characteristics of the welding circuits being taken care of by proper selections of the resistors, coils, etc., in the control.

The welding head consists essentially of a set of rollers for

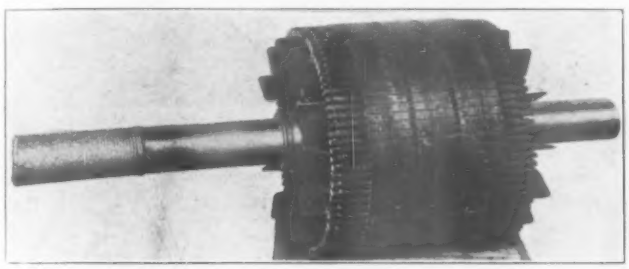


Fig. 4. Worn Shaft of Induction Motor Built Up by Automatic Arc Welding.

gripping the wire and feeding it to the arc. These rollers are suitably connected through gearing to a small direct current motor, the armature of which is connected across the terminals of the welding arc. This connection causes the motor to increase in speed as the voltage across the arc increases due to an increase in the length of the arc and to

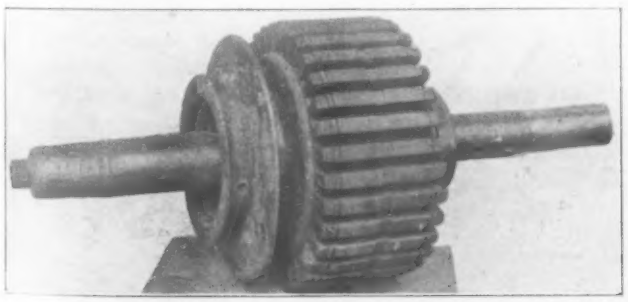


Fig. 5. Tapered Extension of Motor Shaft Built Up by Automatic Arc Welding Machine.

decrease in speed as the voltage decreases due to a shortened arc. A small relay operating on the principle of a generator voltage regulator is connected in the field circuit of the motor which assists in the speed control of the motor as the arc voltage varies. Rheostats for regulating and adjusting the arc voltage are provided by means of which the equipment can be made to maintain steadily an arc of the desired length and this value may be varied from over twenty to as low as nine volts. No provision is made for adjustment of the welding current since the operation of the automatic ma-

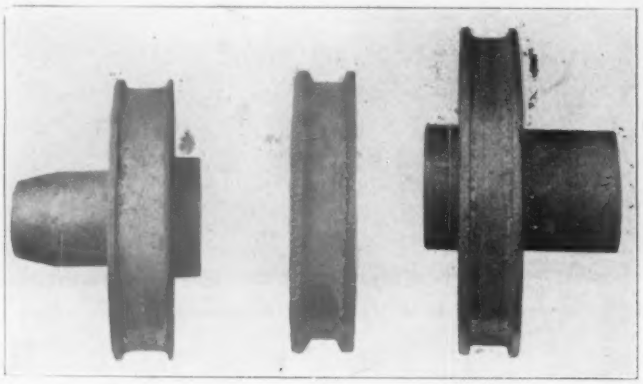


Fig. 6. Worn Crane Wheel Flanges Repaired by Electric Arc Welding Process.

chine is in no way dependent on it. This adjustment is taken care of by the control panel of the welding set. This may be either of the variable voltage or constant potential type but it is necessary to have a source of constant potential to excite the fields of the feed motor. It may be possible to

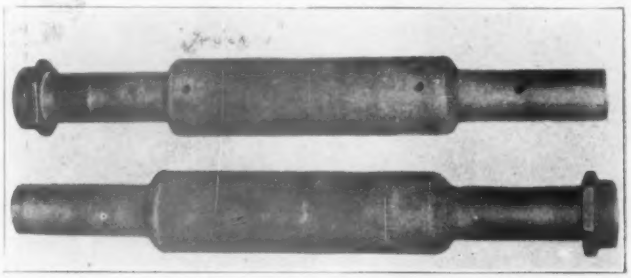


Fig. 7. Water Jacket Formed of Steel Tubing Assembled by Automatic Arc Welding.

obtain this excitation from the welding circuit but this is not essential. The voltage, of both the welding and constant potential circuits is immaterial provided it is not too high, but these voltages must be known before the proper rheostats can be supplied.

Observatioin of indicating meters on the control panel

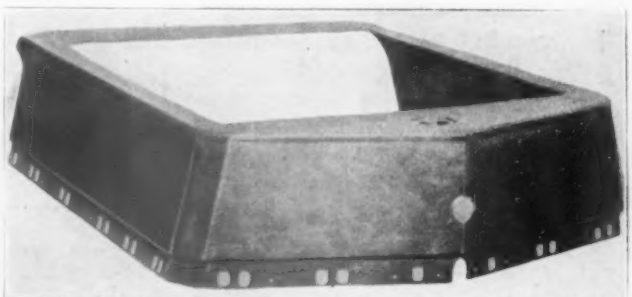


Fig. 8. Radiator Cover of No. 19 Gauge Metal (.044" thick) Welded with Metallic Electrode by Automatic Arc Welding Process.

show that the current and voltage are practically constant, but it should be remembered that all indicating meters have a certain amount of damping which prevents the observation of variations which are extremely rapid or of small magnitude. The resultant value as read on the instrument is the average value. Oscillographs taken with short arcs show

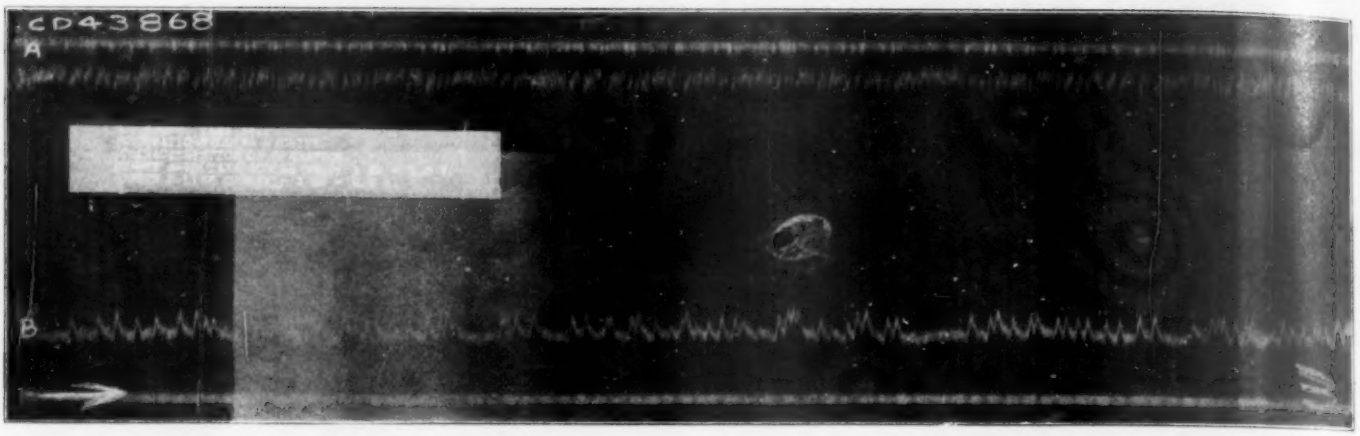


Fig. 9. Automatic Welding Machine. Characteristics of Operation. Curve A—Voltage Across Weld. Curve B—Line Current.

Fig. 10. Hub Stamping of 3/16" Material with 1/16" Dust Cover Welded with Metallic Electrode by Automatic Arc Welding Process.

that notwithstanding the fact that the indicating meters show a constant value, a succession of rapid short circuits is continually taking place, apparently due to particles of the molten wire practically short-circuiting the arc in passing from the electrode to the work. This is indicated by the fact that the voltage curve fell to zero each time and accompanying each such fluctuation there was an increase in the current. It was found that with the shorter arc the frequency of occurrence of these short-circuits was considerably higher than was the case when the arc was increased in length. To all appearances the arc was absolutely steady and continuous and there was no indication eithe by observation of the arc itself or of the instruments that these phenomena were occurring.

The following tables give an idea of the speed of welding which may be expected but it should be borne in mind that these figures are actual welding speeds. It is necessary to have the material properly clamped and supported and to have it travel past the arc at a uniform speed. In some cases the figures given have been exceeded and under certain special conditions it may be desirable to use lower values than those given.

Fig. 11. Motor Shaft Built Up by Automatic Arc Welding.

Seam Welding

Thickness in inches	Amperes	Speed, inches per minute
.040	45 to 50	20 to 30
1/16	50 to 80	15 to 25
1/8	80 to 120	6 to 12
3/16	100 to 150	4 to 6

Building Up (Wheels or Shafts)

Dia. or Thickness Inches	Electrode Dia. Inches	Amperes	Speed, In. per minute	Lb. deposited per Hour
Up to 1"	1/16	60 to 90	11 to 13	1.04-1.56
Up to 3"	3/32	90 to 120	6 to 8	1.59-2.1
Over 3"	1/8	120 to 200	4 to 6	2.5 -4.5

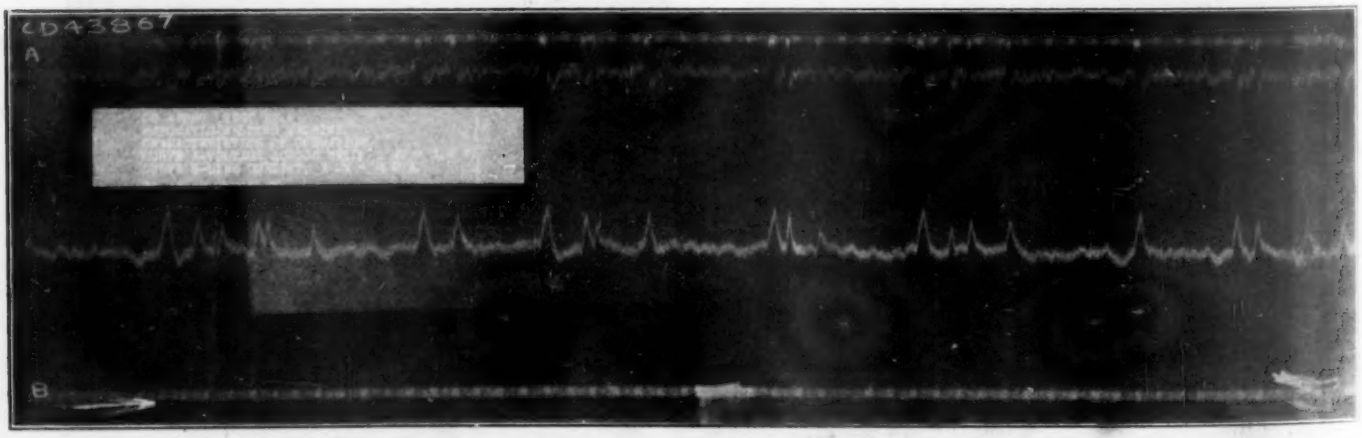


Fig. 12. Characteristics of Operation. Curve A—Voltage Across Weld. Curve B—Line Current.

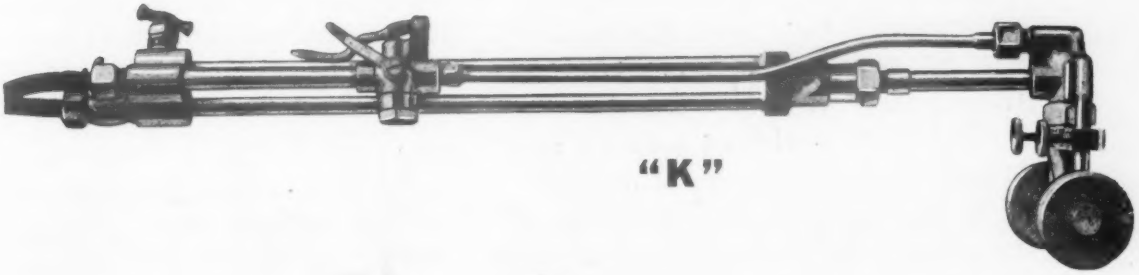
GENERAL WELDING & EQUIPMENT CO.

G.W.&E.C.

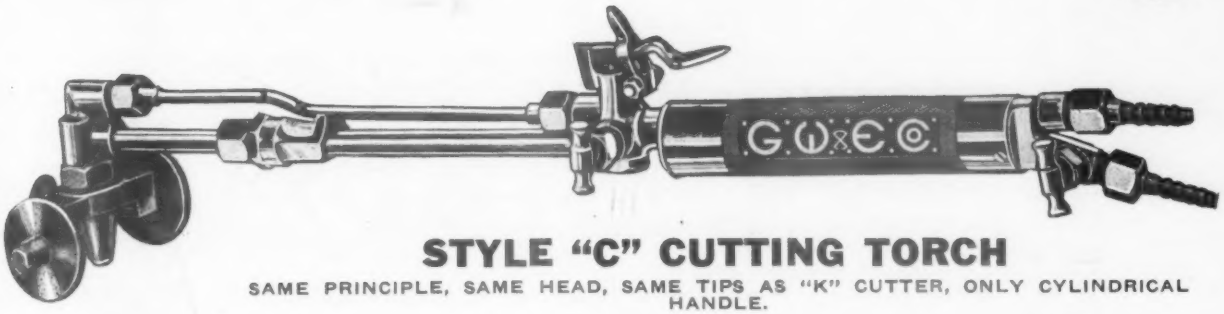
107 MASS. AVE. BOSTON, MASS.

THE FAMOUS "K" CUTTING TORCH

MANY THOUSANDS OF THESE CUTTING TORCHES ARE IN CONTINUOUS USE IN THE U. S. AND CANADA

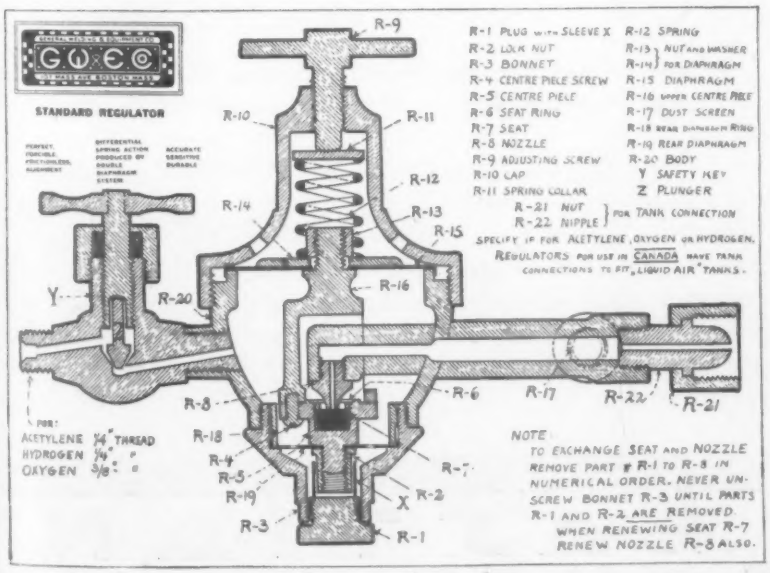


"K"



STYLE "C" CUTTING TORCH

SAME PRINCIPLE, SAME HEAD, SAME TIPS AS "K" CUTTER, ONLY CYLINDRICAL HANDLE.



DOUBLE DIAPHRAGM REGULATOR

MOVABLE CENTREPIECE R-16 CARRYING SEAT R-7 IS NOT ONLY FASTENED TO MAIN DIAPHRAGM R-15 BUT ALSO TO PERFORATED REAR DIAPHRAGM R-19 THUS ENFORCING AN ABSOLUTELY STRAIGHT AND FRICTIONLESS UP AND DOWN MOVEMENT OF SEAT R-7. REAR DIAPHRAGM R-19 ALSO ACTS AS A SENSITIVE DOUBLE WAY SPRING, THUS INCREASING SPEEDY ACTION OF MAIN DIAPHRAGM R-15 AND PREVENTING IT FROM BEING OVERSTRAINED AND FROM BUCKLING.

NO OTHER REGULATOR HAS THESE REMARKABLE FEATURES.

WELDING AND C

What Do You Know About Torch Principles

We all know that daily there is a great deal of poor welding executed welding which really isn't welding, which won't stand the stress and stra to which the ordinary weld is subjected.

Largely, of course, this poor welding is due to poor workmanship, but n necessarily so. The gases used, the regulators, the welding rod, and la but by no means least, **the welding torch**—all have a very vital bearing the quality of the weld.

To some welders a torch is a torch. Daily, you will hear stated that a torch which delivers a neutral welding flame is a proper torch to opera and that the principles employed in constructing the mixing chamber ha nothing whatever to do with the quality of the flame produced at the t or the economy of operation.

No statement could be further from the truth.

A manufacturer of a welding torch has to bear in mind certain basic laws if the to produced is to be a proper torch to operate. He must, as far as possible, do away with **persistent and annoying flashback** and to do this it has always been deemed necessary to sp up the gases as they mix. Prior to the invention of the REGO principle, this speeding of the gases consisted of introducing the oxygen under a **considerably higher** pressure t **the acetylene.**

The manufacturer of a good welding torch must also plan to get his **pressures as low possible** so that the torch will use up almost all the gases in the cylinder; also produc "soft" flame.

He must also bear in mind that the consumption should be **equal volumes** of oxygen a **acetylene.**

Here are some basic principles which are apparently inconsistent—**low pressure, oxygen pressure,** and at the same time a **velocity of mixed gases** sufficient to eliminate flashback.

It is a matter of proved fact that there are many welding torches on the market wh use as much as two feet of oxygen for each foot of acetylene. In a case of this kind, th is a waste of 50% of oxygen.

Study now, the REGO principle. It delivers the acetylene to the mixing chamber a pressure very **slightly in excess** of that of the oxygen; yet, at the same time, this acetyl pressure **is not as great** as that used by many of the medium pressure or positive press type torches, and about half that of equal pressure torches. Here, we meet then, one of basic principles, that is, low pressures.

THE BASTIAN B
WEST AUSTIN AVENU

TING APPARATUS

Because of the introduction at the mixing chamber of the acetylene under a slightly her pressure than the oxygen, no flashback can result provided regulators are in good rking order, and the gases being used are proper, because each time there is a condition sent where the ordinary torch would flash, the acetylene being under a slightly higher ssure than the oxygen, shuts off the oxygen **and so prevents flashbacking.**

Recall now that the theoretical consumption of any welding torch should be equal vol-es of both gases. Remember that it takes two and one-half volumes of oxygen to com-tely consume or burn one volume of acetylene; so that the tendency of all torches is to as much oxygen as possible. Here then, the REGO meets another basic condition—acetylene being under a slightly higher pressure than the oxygen, dams, or holds back, excess oxygen from coming through the flame and the REGO principle positively pre-ts the consumption of more than the theoretical volumes of both gases.

The method patent under which REGO torches are constructed, reads that **"the main jects of the invention being to prevent the occurrence of flashbacks, reduce the consump-n of oxygen, and attain the theoretical mixture of one volume of acetylene to one of ygen."**

The oxy-acetylene industry is so new that it is not strange that welders or manufacturers ve not yet become sufficiently acquainted with torch construction, to realize the tremen-us importance of principles employed.

The REGO torch:

1. **Eliminates the flashback.**
2. **Uses lower combined pressures.**
3. **Prevents any excess oxygen from coming through the flame.**
4. **Makes possible better steel welding because of a better quality flame.**

Before the introduction of the REGO torch, it was a rare, if not unknown occurrence, to e principles of torch construction described. It was very common to see broad general ims, but specific claims were lacking. The REGO changed that. We believe in publicity **in telling the user the difference in torch principles.**

No welder or manufacturer should buy a torch or use a torch, unless he knows the prin-ples employed in its construction are correct. It is not a difficult matter to make quite easy sts in your own shop and without the aid of any technical instrument, to determine the periority of principles employed in torch construction.

Thousands of REGO torches are now in daily use throughout the country. We want any, many more thousands in use, and we are willing to prove to you that the REGO is the rch which you must eventually use.

SSING COMPANY
LA SALLE STREET CHICAGO.

On account of the great variation in conditions under which this equipment may be used it is provided with a base which may be bolted to any form of support. It may be held Stationary and the work traveled past the arc or the welding head may be movable and the work held stationary. These points will be dictated by the relative size of the work and the head and the equipment which may be available. Provision must be made for traveling one or the other at a uniform speed in order to carry the arc along the weld. In the case of straight seams a lathe or planer bed may be utilized for this purpose and for circular seams a lathe or boring mill may be used. In many cases it will be found desirable to use clamping jigs for securely holding the work in shape and also to facilitate placing in position and removal from the feeding mechanism.

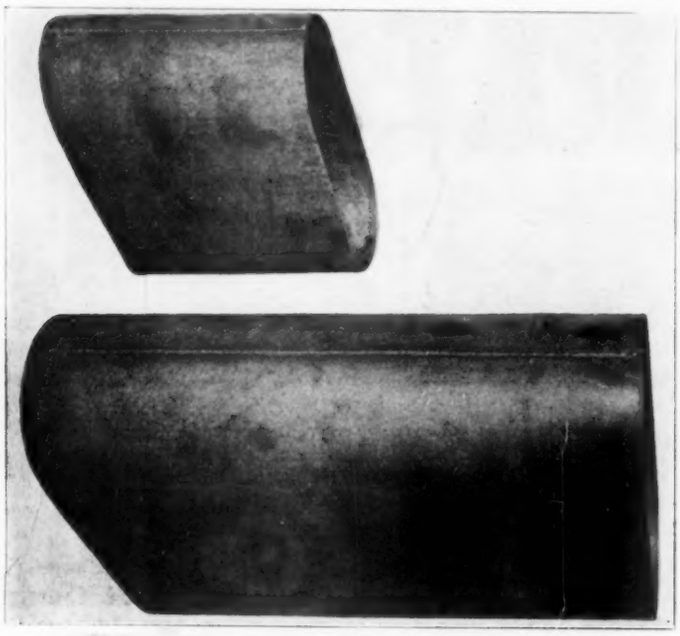


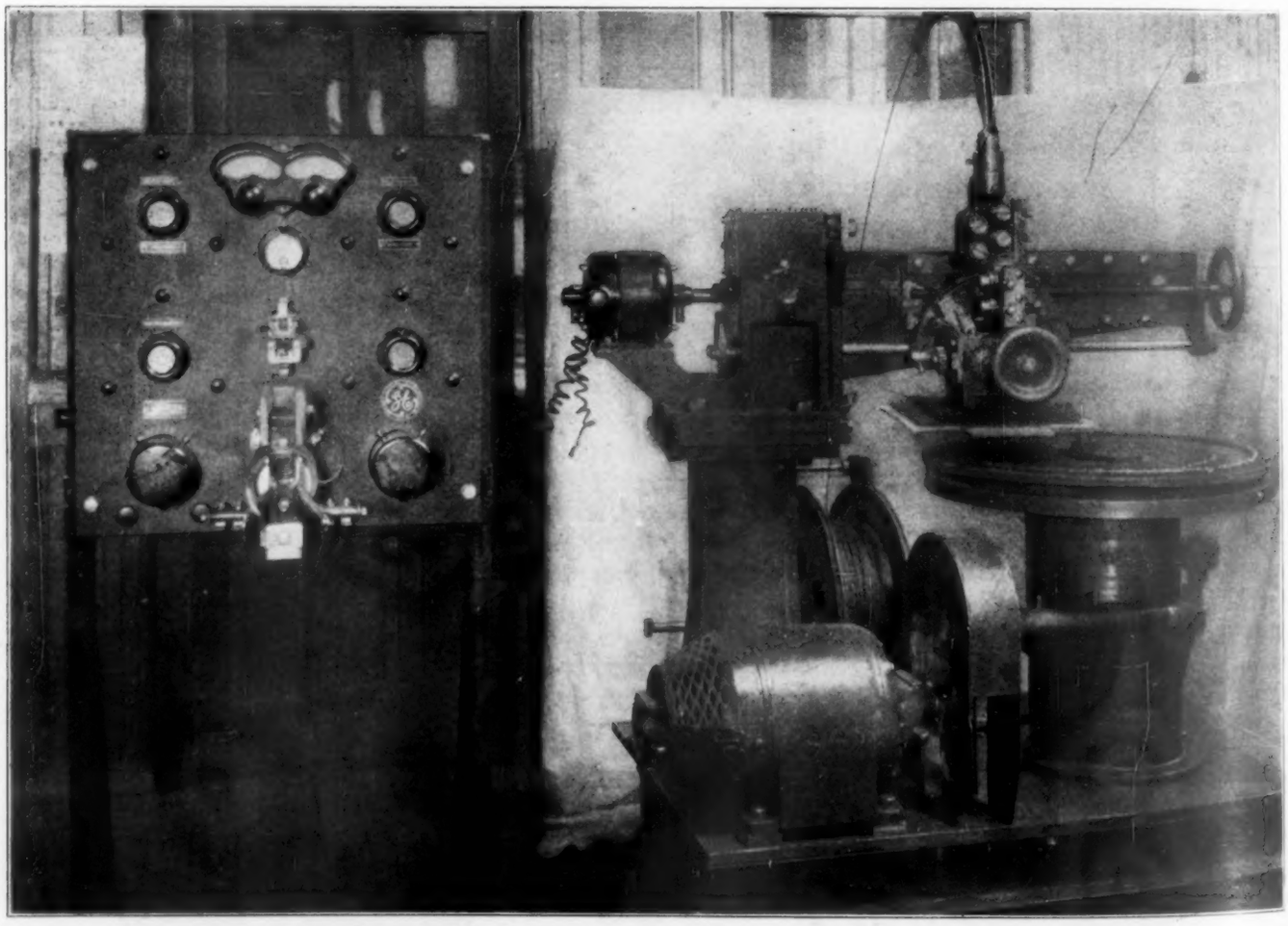
Fig. 13. Oil Switch Tanks with Seams Welded by Automatic Arc Welding.

The principal field for this device is where a considerable amount of welding is required, the operations being a continuous repetition of duplicate welds. Under these conditions one can economically provide jigs and fixtures for facilitating the handling of the work and the clamping. Thus can be reaped the benefit of the increased speed in the actual welding which would be lost if each individual piece had to be clamped and handled separately.

Occasionally illustrations appear in *The Welding Engineer* which could be used to advantage by job welding shops for advertising purposes. As these halftones are eventually destroyed, The Welding Engineer is glad to loan them to job welding shops for advertising purposes.

Mr. F. R. Goehler has been appointed sales manager for the Bastian-Blessing Co., Chicago, manufacturers of Rego welding equipment. Mr. Goehler founded the Weldcraft Equipment Co., Pittsburgh, prior to which time he was a district manager for the Oxweld Equipment Co.

The Metal & Thermit Corporation, 120 Broadway, New York, have published a booklet on the subject of Pipe Welding.

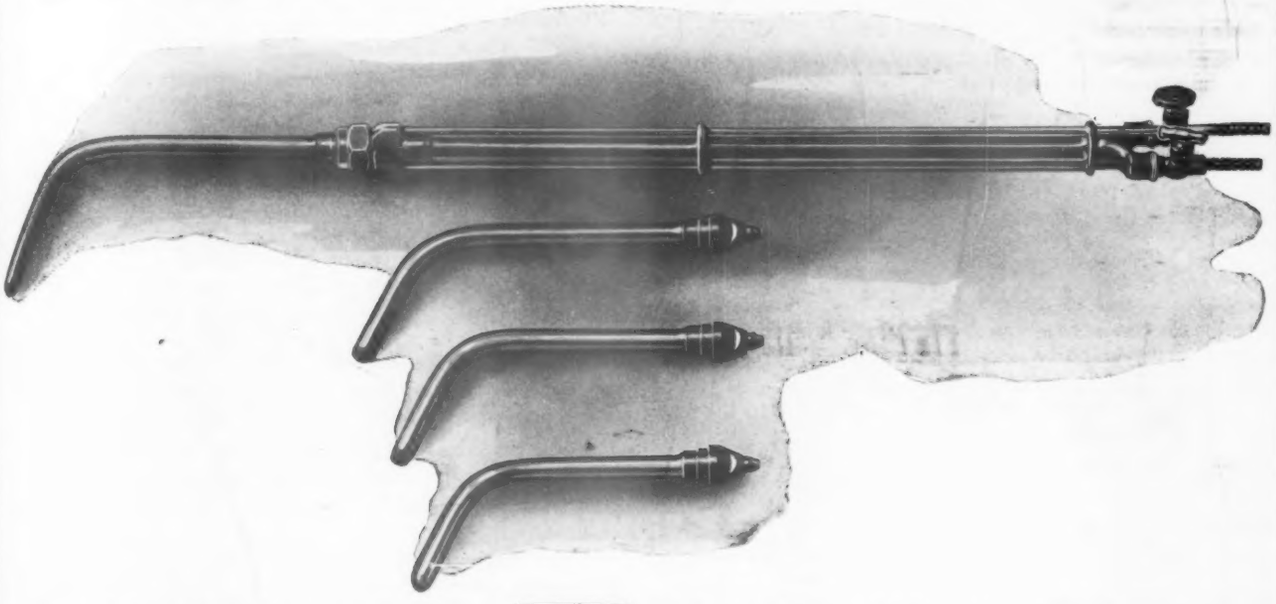


Automatic Arc Welding Machine.

VICTOR
PRODUCTS LEAD

Victor Water-Cooled Welding Torches are a distinct advance in Oxy-Acetylene welding devices.

To build a torch of this type that is a gas saver and will work under all pressures of gases and conditions requires a practical knowledge of welding as well as Engineering skill. Victor Water-Cooled torches were designed from experience gained by being behind the "Gun" working with the torch on heavy hot jobs until perfection in the construction of the torch was reached.



The mixing chamber and nozzles for length of from 12″ to 16″ are completely water-cooled insuring cool gases on the hottest jobs, enabling the operator to weld up deep holes left in steel castings by cold shuts, weld down in cylinders, and corners, also heavy castings where the preheating fire must be kept going. Flashbacks are unknown with Victor Torches.

This work is done in one-half the time and gases than with any other torch. Why? Because Victor Water-Cooled Torches are operated continuously and the welding flame is not extinguished until the job is finished. Gases are always cool and the full amount of heat units are delivered to the point of combustion, utilizing all of the gases.

The four nozzles are interchangeable and graduated for various sizes of work, giving the widest range.

Nothing like it upon the market. Victor Torches are not Bunco. Get the "Reasons Why".

Valuable territory open to Agents who can sell high class apparatus.

Victor Oxy-Acetylene Equipment Company

10 North Jefferson St., Chicago, Ill.
68 Grand River Ave., Detroit, Mich.
884 Folsom St., San Francisco Calif.
266 Glisan St., Portland, Oregon

PROPOSED FRENCH REGULATIONS FOR HIGH PRESSURE CYLINDERS.

The Chambre Sydicale de la Soudure Autogene (the French Welding Association) has recently issued a brochure on the subject of their findings relative to high pressure containers for gases, together with their recommendations for a new code proposed.

The growing importance of the compressed gas industry and the many laws in France, municipal and county, covering the transportation of gases has forced the movement for a unification of laws regarding the test of cylinders. A committee was appointed in 1913 to study the subject, but their work was interrupted by the war, and was not resumed until 1919. The new committee was made up of the men most prominently identified with the compressed gas industry in France, together with representatives of cylinder manufacturing companies and independent engineers. All persons having any interest in the industry were invited to make suggestions. Seven general principles were adopted by the conferences. They were:

1. Government regulations only were to be applied to compressed liquified or dissolved gases and their containers.
2. The manufacturers of containers were to be given wide latitude in the selection of materials and methods of manufacture of containers, but the responsibility was to be entirely the manufacturers for a satisfactory article.
3. There was to be no limitation as to length or diameter of the containers.
4. The pressures formerly specified by the Minister of Public Works as test pressures were to be lowered to correspond more nearly to the test pressures employed in other countries.
5. The delays between retests were to be extended to agree more nearly to the practice in other countries.
6. Simple but severe rules were to be laid down for the test and retest of containers by the officials designated for the work.
7. The tests and retests were to be carried out to the exact demands of the code.

The regulations proposed to the Government as the result of committee meetings and conferences follow:

Proposed Regulations for Metallic Containers for Compressed, Liquified and Dissolved Gasas.

Section 1. General Considerations.

Article One. The gases contained in metallic cylinders are divided into three categories:

a. Compressed gas, not explosixe.
b. Liquified gas, not explosive.
c. Compressed, liquified or dissolved gas explosive.

The explosive gases are those which, compressed, liquified or dissolved give rise, in the course of transportation, handling or use to a decomposition or transformation, provoking a sudden explosion.

Article Two. All containers which owing to their nature or contents and used for the transportation of a gas found in one of the classes specified under Article One, shall be required to be submitted to an official test and to subsequent retests under the conditions specified hereafter. Without such a test and retests being made they may not be used for transportation either on the railroad or on public roads.

Article Three. The first tests and subsequent retests shall be made under the direction and in the presence of an engineer of the Bureau of Mines or of employees of organizations authorized for this purpose by the Minister of the Bureau of Mines, such as the Association of Manufacturers of Apparatus for Steam, the Bureau Veritas or other competent organizations.

Article Four. The first test and subsequent retests that are successfully passed shall be made a record of by placing an official mark on the container in the manner specified hereinafter.

For the first test the container shall bear a distinctive mark of the manufacturer, or failing that of the owner, a serial number and a statement as to the nature of the contents of the cylinder. In addition the container shall be furnished with a medallion or a shield made of the container on which shall be marked the test pressure of the cylinder in kilograms per square centimeter. This figure is to be preceded by the letter "E" (Epreuve-test).

Below this inscription is to be reserved a place for marking the date of the first test.

After the test is successfully made the date shall be inscribed on the container by means of a metal punch. The agent making the test either for the Government or authorized by the government shall place a special mark on the container to the right and left of the pressure figures.

Article Five. For a retest the date of the test shall be simply inscribed by punch. To the left of this the agent making the test shall place the mark of the government or the mark of the special organization authorized to make the test. The record of the first and any succeeding tests, together with the test pressure, shall be clearly legible at all times.

In all cases the placing of the medallion or shield, the preparation of the necessary marks and all equipment, except the pressure gauge, shall be supplied by the person owning the containers.

Article Six. Each container shall be supplied with a valve specially designed for the gas employed, and each valve shall have a valve protecting cap.

Article Seven. The valves for the containers shall have a progressive opening for the discharge of gas, that is, the amount of issuing gas shall be proportional (within limits) to the degree the valve is opened. In addition they shall be so designed as to provide a fusible plug as a safeguard against an abnormal rise in temperature. (Note 1.) For oxygen the employment of grease containing lubricants is prohibited for use in or on all parts coming in contact with the gas.

Section 2. Compressed Gas, Not Explosive.

Article Eight. The test pressure and the retest of containers for gases, compressed but not explosive, shall be as follows:

For containrs for compressed gases of which the pressure at 15 degrees Centigrade varies from one to eight kilograms per square centimeter (0 to 1,137.6 pounds per square inch) the test and retest pressure shall be the same as the pressure to the gas at the same temperature, but increased by four kilograms per square centimeter (57 pounds per square inch).

For containers for compressed gases of which the pressure at 15 degrees Centigrade is greater than eight kilograms per square centimeter (1,137.6 pounds per square inch) the test and the retest pressure shall be one and one-half times the pressure of the gas at 15 degrees.

Article Nine. The hydraulic tests are to be imposed in exactly the same manner for all tests, with the exception of the pressure requirements as set forth in the Eighth Article.

The test shall be made cold. The container shall be clean inside and outside, and shall be exactly filled with cold water. All apparatus used for the test shall be in place and shall be independent of other apparatus. A temporary valve may be used in place of the standard cylinder valve. It is to have, however, the same size thread for insertion that the standard valve has.

No escape of water shall be permitted even in the form of an oozing. The agent conducting the test shall examine with all care after the test the surface and sides of the container, to assure himself that there are no signs of escape of water or damage to the container. The sides of the container (walls) shall be visible during the test. The agent, before and after the tests shall take all necessary measures to assure himself

The WIEDERWAX-PREHEATER-REVOLUTION

in the Science of Preheating and Welding demands the attention of every Welder.

The two most essential points in Welding are:

First, the use of a proper preheater;

Second, a perfect, even and steady heat at all times with a perfect control while applying to castings being preheated for welding.

We are the only manufacturers of a Preheater that will preheat with 100% efficiency, without the time of setting up torches or making fires, and a preheater that is always ready for duty, with a greater saving of fuel than any other known method on the market today.

Uneven heating does not only destroy the work of an efficient Welder, but reduces the production where welding is being conducted.

The **WIEDERWAX PREHEATER** preheats anything.

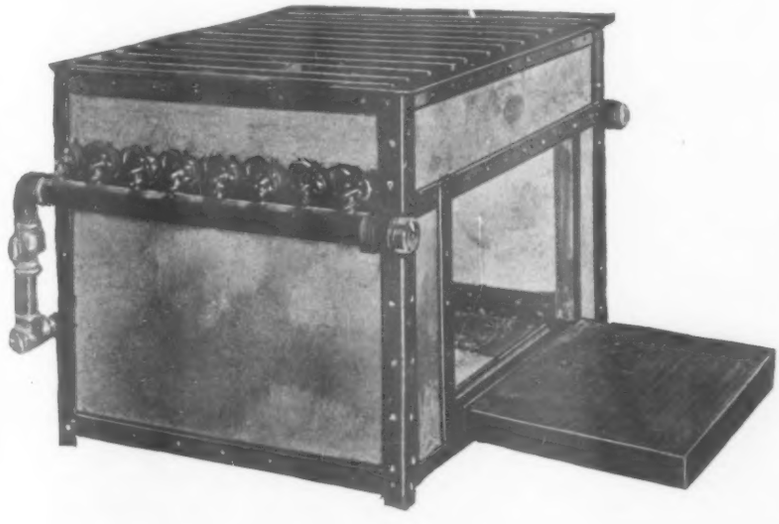
The **WIEDERWAX PREHEATER** leaves no hard spots because of its even and efficient heating, combined with its even cooling arrangement on the one type manufactured by us, consisting of a cooling oven,—illustration of which is shown in the lower left-hand corner.

The **WIEDERWAX PREHEATER** is the only reliable preheater on the market.

The upper right-hand corner shows our floor type **WIEDERWAX PREHEATER,** constructed for large, heavy work.

The **WIEDERWAX PREHEATER,** if used, will increase production from 15% to 25%.

The time and labor that the **WIEDERWAX PREHEATER** will save you makes it worth more than your mere consideration of reading this ad.



Full particulars will be gladly furnished by writing for same

GEIST MANUFACTURING COMPANY

Department X

Atlantic City, New Jersey

that there have been no permanent deformations in the container.

The interval between the first test and first retest shall be five years and between each succeeding retest five years shall elapse.

Article Ten. For containers autogenously welded, regardless of the process employed, all the welded parts shall be, during the time of test and while the container is under hydraulic pressure, tested with a hammer by successive blows along the length of the weld. The weld shall resist this test without permitting the escape of any water.

Section 3. Liquified Gas, Not Explosive.

Article Eleven. Containers for this type of gas shall be tested in accordance with the provisions of articles nine and ten. They shall also conform to the conditions specified in Section one.

However, for chlorine and hydrogen sulphide which in certain circumstances exerts a chemical effect on the metal, the retesting shall be carried out every three years.

Article Twelve. The test pressure and subsequent retests for gases are shown below as well as the minimum capacity corresponding to each kilogram (2.2 lbs.) of liquified gas. (Note 2).

	Test pressure Kgs. per sq. cm.	Lbs. per sq. in.	Minimum capacity per Kg. of liquified gas
Nitrous oxide	180	2559.6	1.34 (2.94 lbs.)
Anhydrous ammonia	45	639.9	1.86 (4.09 lbs.)
Chlorine	35	497.7	.8 (1.76 lbs.)
	25	355.5	.8 (1.76 lbs.)
Phosgene	30	426.6	.8 (1.76 lbs.)
Carbon dioxide	180	2559.6	1.34 (2.94 lbs.)

Section 4. Gas Compressed, Liquified or Dissolved and Explosive.

Article Thirteen. All conditions specified under Section 1 shall apply as well to compressed, liquified or dissolved gas that is explosive. Conditions specified under article nine and ten of Section 2 shall also apply except that the interval elapsing between successive retests is changed to agree to the time limit specified for the different gases coming under this category.

Article Fourteen. Explosive gas, compressed, liquified or dissolved in a liquid and contained in a metallic container shall conform to regulations made in advance of putting the container into service.

However, acetylene shall be authorized to be used in a dissolved state under the conditions specified hereinafter.

Article Fifteen. The regulations specified in preceding articles shall be generally applied to acetylene with the following additions:

(a) The pressure shall not exceed in any case a pressure of fifteen kilograms per square centimeter (213.3 lbs. per sq. in.) at fifteen degrees centigrade.

(b) The test pressure and successive retests shall be fixed according to the following:

Sixty kilograms per sq. centimeter (853.2 lbs. per sq. in.) shall be the test and retest pressure if the interval of test is to be ten years.

Ninety kilograms per square centimeter (1279.8 lbs. per sq. in.) shall be the test and retest pressure if the interval of test is to be fifteen years.

Before the initial test of the container the owner shall advise under which of the above classes the container is to be tested.

(c) The containers shall be filled with a porous mass without openings or cavities and shall stop a propagation of an explosion. The porous mass shall be tested as hereinafter explained by competent authority.

(d) The solvent shall be without the slightest chemical action on the acetylene, or on the porous mass and the porous mass with the solvent shall have no chemical effect of any kind on the metal of the container.

(e) No metal which shall come in contact with dissolved acetylene shall be of a metal alloy containing more than 30 per cent of copper.

Article Sixteen. As an addition to the specifications of Article Four, every container designed for use with dissolved acetylene shall bear on a name plate or other means the following information, either entirely written out or initials only:

1. The nature of the solvent.
2. Weight of the container including valve, porous mass, the solvent and the acetylene in solution at one atmosphere pressure (147 lbs. per sq. in.).

Information as to the nature of the porous mass.

Article Seventeen. The containers shall be entirely filled with a porous mass which shall have been first approved of by competent authority. Before containers are tested a sample of the porous mass shall be submitted together with a description of its method of manufacture and its analysis to a competent authority. (Note—It is planned to have the Bureau of Powder and Explosives of the French Government serve as this competent authority.)

Article Eighteen. The porosity of a mass shall be defined as the proportion existing between the free space within the mass and its total mass. For acetylene the porosity shall not exceed 80 per cent of the total volume.

Article Nineteen. The quantity of solvent introduced into the container shall be such that counting the porosity of the porous mass and the volume occupied by the solvent and filled with acetylene to the limit of pressure specified there will be a volume remaining equal to 15 per cent of the water capacity (Volume) of the container. This 15 per cent is intended to provide for space for expansion of the containers contents due to rise in temperature.

Article Twenty. The containers, filled with porous mass, shall pass the following tests:

1. A container, filled with porous mass but containing no solvent, shall be charged with acetylene to 20 kilograms per sq. centimeter (284.4 lbs. per sq. in.) at a temperature of 15 degrees Centigrade. In this condition it shall be subjected to a spark or a flame in the interior of the container, there shall result neither an appreciable propagation of the flame or a rise in pressure exceeding one-half of the initial pressure.
2. A container filled with porous mass and with a normal charge of solvent shall be charged with acetylene to a pressure of 20 kilograms per square centimeter (284.4 lbs. per sq. in.) at 15 degrees Centigrade. It shall be subjected to and resist a test as specified in the preceding paragraph.

Article Twenty-One. The competent authority in charge of the test shall decide as to whether or not a container and porous mass has fulfilled the condition provided in the preceding article. In case of a question being raised as to his findings or upon his refusal to give satisfactory justification for refusing to accept the porous mass additional tests shall be made, in accordance with the provisions of Article Twenty, on four containers chosen at random from a lot of containers. Disapproval shall follow if the results are not satisfactory.

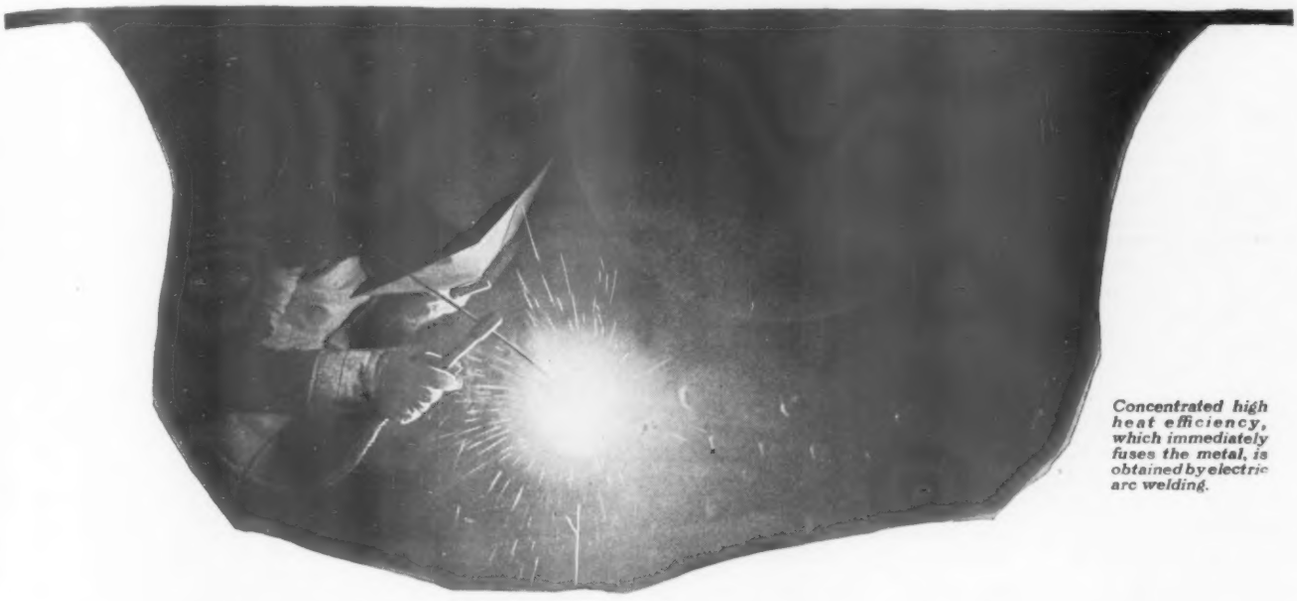
Article Twenty-Two. The retests of the containers shall be carried out every ten or fifteen years as previously stated but for the containers the porous mass of which consists of a solid mass which is not capable of extraction without the destruction of the containers the hydraulic test may be carried out using the solvent instead of water.

The retest may also be carried out by introducing an inert gas into the container and raising the pressure to sixty or ninety kilograms per square centimeter (853.2 or 1279.8 lbs. per sq. in.) as the case may be.

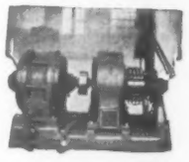
Finally the retests may be carried out by charging the

(Continued on Page 42)

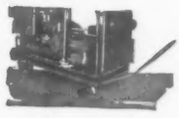
Progressive Industry quickly gives preference to the process which can show its advantages over other methods—the modern way is to do it electrically



Concentrated high heat efficiency, which immediately fuses the metal, is obtained by electric arc welding.



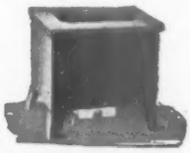
Stationary Arc Welding Set is easily installed for operation



Portable Arc Welding Set permits of maximum use

Other G-E Industrial Heating Equipment:

Tilting Type Electric Brass Melting Furnace—2250 lbs. per hour



Self-Regulating Bench Type Electric Melting Pot for metals—Bulletin 69703

Electric Rivet Heater is essential to quick work well done—Bulletin 69701

Electric Soldering Iron—Production Helps in Booklet B-3514

Utilize electric heat to the utmost

The essential value of electric heating equipment to modern industrial development is apparent in the large demand for various installations of this order to meet increased production schedules.

Slow and laborious processes which retard production must give way to units that employ electric heat—and one of the most essential of the improved methods is *electric arc welding.*

Electric arc welding maintains advantages in quantity, quality, and cost—wherever iron or steel is to be joined in repair work, salvage, or original manufacture. The utilization of its possible applications extends over steel and iron works—boiler shops—foundries—repair shops—machine shops—and innumerable other industries.

An unusual simplicity and elasticity of operation has been perfected in the designs of Stationary and Portable Arc Welding Sets manufactured by the General Electric Company. This equipment can be provided for either group or single operator service, and generator can be driven by any source of power—engine, belt, d-c. or a-c. motor. Send for Bulletin 48932-A.

To stimulate correct operation, the General Electric Company has established an Arc Welding School at Schenectady, which offers exceptional training in horizontal, vertical, and overhead welding under actual production conditions—free to a limited number of men. Bulletin No. 48953 sent on request.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

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VOLUME 5. JULY, 1920. NUMBER 7.

A Patent Device.

THE Editor of the Columbus Dispatch says: "The old Liberty Bell is not half so badly cracked as that addle-pated Philadelphian who wants to weld it with his patent device." If he ever has a big press break down, and is actually "up against it," he may acquire a little more respect for "that patent device."

Chicago Chapter of American Welding Society.

AT a meeting held in Chicago recently to discuss the question of organizing a Chicago Chapter of the American Welding Society a committee was appointed to draft tentative by-laws and a constitution and plans of operation for the chapter. This committee is to report back to another meeting of welding interests in Chicago, which will be held in the auditorium of the Western Society of Engineers in Chicago, Monadnock Building, at 7:30 p. m., on Tuesday, August 3rd. Everybody interested in welding is invited to be present.

The Liberty Bell.

THE Philadelphia Public Ledger, one of our foremost American newspapers, has reviewed the old question of whether we shall weld the old Liberty Bell or not. Most newspapers, make a sad mess of it when discussing technical subjects and this is no exception to the rule. The Literary Digest commented on this article in the issue of June 26th. The comment follows:

Shall the liberty bell, long silent, become vocal again? Electrical engineers tell us that the crack in it can be welded and that it can then be rung as of old. D. H. Wilson, a New York engineer, has even definitely proposed the operation. To most of us, the crack in the bell has become part of it and its restoration seems almost like sacrilege. Yet, when we break an arm or a leg, we have it set at once. Why not cure the old Liberty Bell? It continued to ring out merrily for nearly sixty years after it had "proclaimed liberty to all the world." Why should it not speak out, after its eighty-five silent years, in honor of many another joyous event? In the Philadelphia *Public Ledger* Charles W. Duke tells of the proposal to "cure the Liberty Bell" and of how the cure may be effected. The last time that the bell spoke was at Chief Justice Marshall's funeral, in July, 1835. Writes Mr. Duke:

"Electrical engineers interested in the proposition of welding would piece the sacred old bell together. Electricity, the magic power of modern industrialism, would be the medium applied not alone to close the breach in the bell, but to cure it of its chronic metallurigcal disease—slow disintegration—by applying the latest developments in the therapeutics of mineral matters.

"The project was discussed at recent meeting of the American Welding Society. It remains for the guardians of the bell and the American people, to whom it belongs, to say whether the invalid bell, with its supposedly fatal wound, shall be summoned into the electric clinic—or left to its fate.

"It is D. H. Wilson, the New York engineer, who proposes the surgical operation. You don't recall Wilson? He is the man who fitted up anew the damaged German merchant marine. Remember, when the United States threw down the gauntlet to Germany in April three years ago, how the Hun retaliated by putting out of commission nearly every German merchant liner tied up at American wharves. Axes were swung, explosives were used, and intricate machinery with which these ships were propelled was 'bashed in,' in the belief that the Yanks never would be able to repair these ships in time to turn them against the Fatherland. Looking over the 'wrecks,' some engineers said it would take a year or more to repair those ships and put them back in commission. New parts would have to be installed.

"Then along came Wilson with his electric-welding needle. It is a matter of history, of course, that in from three to four months every single German liner was ready to put to sea again. Even while Yankee troops were wiping out the St. Mihiel salient and sweeping clean the Argonne, those German ships, led by the giant *Vaterland*, were pouring American men and munitions into England, France, and Belgium. Not only did Wilson and his crew weld the *Vaterland* and her sisters as good as new, but he made them so fleet that our 'gobs' were able to get three knots better speed out of them than the Germans ever had made!"

Not only Wilson, but "Wake-'em-up" Dudley, of the Chester Ship-building Company; B. B. Chichester, the Virginian who developed the science of electric welding under water, and other authorities on welding say the grand old Liberty Bell can be redeemed; that it may have "health glands" transferred to its body that will do for it what the "Fountain of Florida" was supposed to do for decrepit Ponce de Leon. Transfusion, Mr. Duke tells us, would be the process involved, just as in the hospital an anemic is wooed back to life and color again by the injection of pure, fresh blood into his veins; only in this case it would be a mental transfusion. We read further:

"They would proceed in this fashion: Take first a grain of mental from the crevice of the bell. Have it analyzed by a board of expert metallurgists. Reproduce in the laboratories of the alchemist the identical metal of which the Liberty Bell is composed. When you have the proper alloy you are ready to bring on the electric needle.

"Now for the process of welding. Fashion the new metal to be applied into a wire or needle of the welding apparatus. Measure the resistance of the bell and the resistance of the wire after having estimated the amount of steel sufficient to fill up the crack. Now to fill in the crack. One electric contact is made on the bell and the other on the needle that is composed of the same metal substance as the bell itself. Electricity leaps between the two points. . . . Now the process of vaporization is in full blaze. The electric needle is consuming itself and depositing its own particles within the orifice of the

PREST-O-LITE THE PORTABLE

IT matters not *where* the welding and cutting job is, Prest-O-Lite is available. The ship repair work shown here is but one example of Prest-O-Lite portability. Afloat—ashore—anywhere—everywhere.

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PW-508

split bell. Eighty per cent. of the applied power is being consumed on the wire side of the arc. Five per cent of the current is in the arc itself, a burning glare of light that makes the operator shield his eyes behind heavily smoked goggles. Ten per cent of the power is consumed on the negative pole for the purpose of heating the plate which receives the deposit. You simply touch the electric needle to one or the other side of the crack, withdraw it a fraction of an inch, and then repeat the process over and over. Your electric needle, or welding wire, is giving its own life, transferring its very self through the medium of the electric current, to fill out the crevice in the Liberty Bell. Particle by particle, layer on layer, the process continues until the opening is closed. The Liberty Bell is mended just as the surgeon takes a piece of bone from the shin and grafts it on the face to make a new nose—bone for bone and, in this case, metal for metal.

"Not only will it ring, say the welders, but it will have again the same vibrant tone that it had when it was first hung up in the steeple of the State house in Philadelphia in the summer of 1753. The old bell rang first to call the members of the Assembly; it rang when town meetings were held in the State-house yard; it tolled dismally when the Stamp Act went into effect; it electrified the people when the tea-ship, *Polly*, was sent home with its cargo untouched; it saluted the patriots from Boston when they sojourned with the patriots of Philadelphia; it sounded in dirge fashion when Boston was occupied by the redcoats under Gage; it pealed joyously when the news of Lexington and Concord reached the Quaker City, and, finally, it clanged forth as spokesman announcing the birth of the new Republic and the consummation of the Declaration of Independence. For many years after the Revolution it rang out on national holidays, in welcoming illustrious visitors, in mourning the deaths of beloved American patriots. It was tolling on the day when the body of Chief Justice Marshall was being carried in a public funeral procession, and after that day it never tolled again.

"Shall the Liberty Bell ring again? The electric welders would invoke now the magic power that Benjamin Franklin snatched from the clouds with a silken cord and key in the days when the Liberty Bell shone refulgent in the full glory of its mission and make that same beloved relic function anew as it did in the days of youth. . . . . .

"It is asserted by the welders that electricity will also cure the famous bell of its chronic disease. The bell's doctor, Alexander E. Outerbridge, Jr., who holds the chair of metallurgy at Franklin Institute, has held that the bell suffers from a form of distemper. It is to be guarded carefully lest it go all to pieces.

"The electrical engineers now prescribe baths for the bell—electrical baths. Heat it electrically and then allow it to cool slowly. This will eliminate the 'fatigue' of the metal. The heat treatment is recommended regardless of the proposed transfusion. The heat, it is reasoned, would preserve the bell by relieving the stress between the metal particles caused by vibration. Constant vibration wears against the relic, particularly when it is opened to visitors, as in the recent case when the Spanish novelist, Vincente Blasco Ibáñez, clasped and kissed it.

"As for the electric welding for the fissure, another woman may take her place in history beside Betsy Ross and Barbara Frietchie. Women are easily adapted to electric welding. They have the deftness of touch necessary to perfect welding. During the war there was a woman in the Hog Island shipyard who excelled all others as an electric welder. In Baltimore, in the Montclair shops of the Baltimore & Ohio Railroad, there is a woman who earns better than $3,600 a year welding locomotive fire-boxes. A girl who handled high explosives and phosphorus at the Frankfort Arsenal found herself out of a job on armistice day, but speedily 'joined up' again with an electric company in Erie, where she today draws large wages patching steam tractors, automobile parts, anvils, and other metal products that have met with accidents.

"These welding engineers tell us that the world will soon turn to electric welding for virtually all metal-construction work. In labor-saving alone, they point out, the welding process holds the advantage. . . . . Already they are putting automobiles, street-cars, railway rolling-stock, window-sash, horse-shoes, and steel rails together with the tiny twelve ounce electric-welding needle. Now they are proposing to dip down into the ocean with that needle and lift up sunken ships that may be salvaged for their hidden treasure. Pretty soon we may be building the world of to-morrow with an electrified metal pencil that a woman may wield as neatly as the artist sways his brush to and fro over the canvas."

THERMIT PIPE WELDING PAMPHLET

The Metal & Thermit Corporation, New York, N. Y., has just issued and will distribute on request the Third Edition of its Thermit Pipe Welding Pamphlet No. 16. In this new edition the subject of Thermit pipe welding has been revised and brought up to date. The new pamphlet describes and illustrates in detail how Thermit pipe welds are made and contains reports on successful tensile strength and vibration tests of Thermit pipe welds conducted by Stevens Institute. One of the features of the new pamphlet not previously published in former editions is a chart showing the comparatively low cost of a Thermit welded pipe as compared with the cost of installing compression flanges with bolts and gaskets, and of installing elbows with flanged connections. The new edition also contains for the first time an account of a ten year pipe test at West Albany, N. Y., during which 700 ft. of 4 in. extra heavy Thermit welded pipe, which connected a powerhouse of the New York Central Lines with a boiler house, was constantly subjected to a hydraulic pressure of 1,500 lbs. to the square inch without being affected in the least, although some valves were put out of commission.

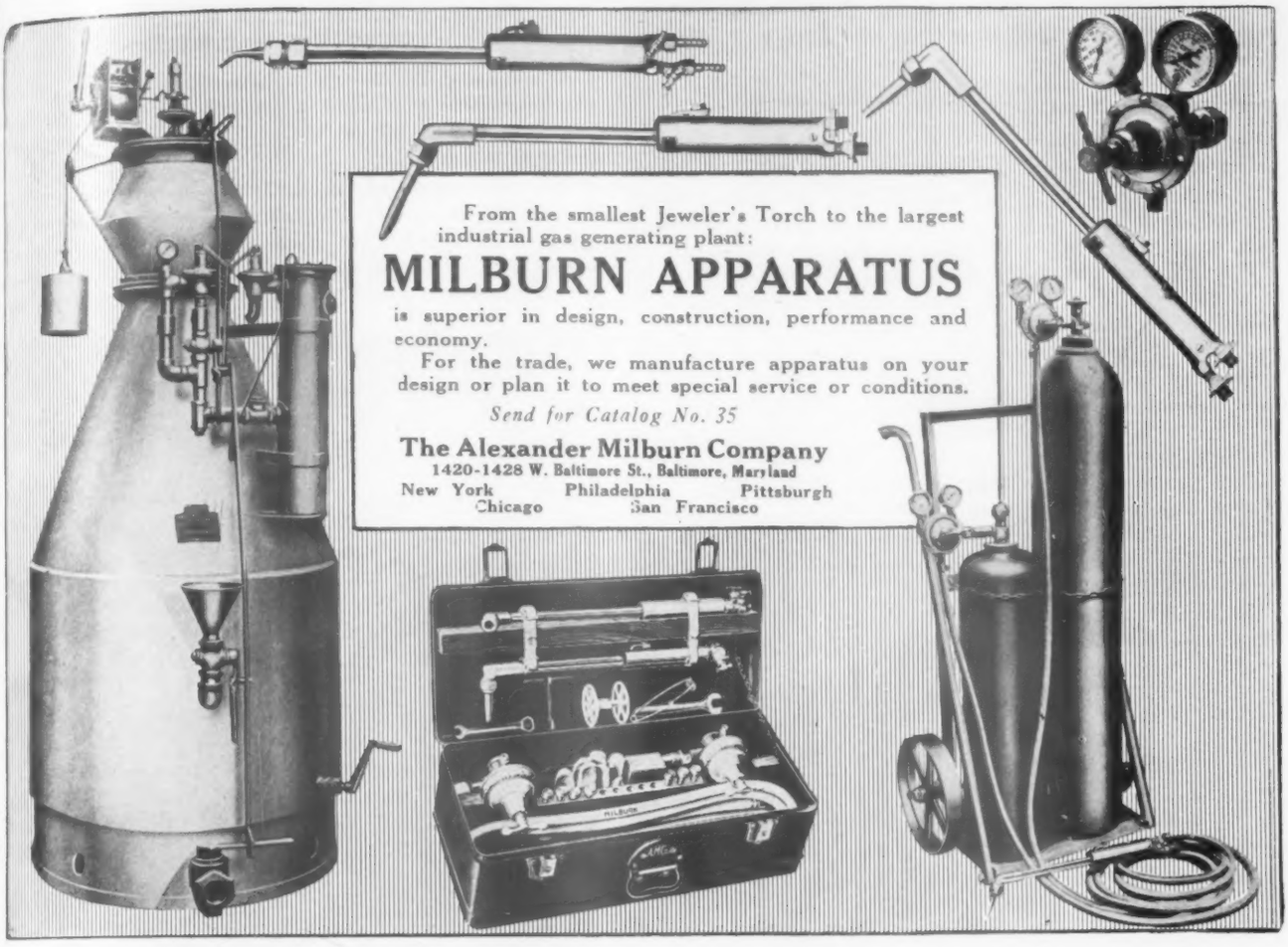
NEW AIRCO PLANT

In line with its policy to meet the ever increasing demands for Airco Oxygen and Acetylene by constantly augmenting its facilities for the production of these products, The Air Reduction Sales Company has just completed the construction of a new acetylene plant, at 560 Broadway, Gloucester, N. J.

The buildings making up this new unit in the Airco Service System consist of a gas house, carbide storage building and a generator house. The gas house is the main building of the plant and contains the compressors and filling lines. It has a brick addition which is used as a locker room and heating plant.

All the buildings are built of fabricated steel and are supported on concrete foundations and have concrete floors.

Among exhibitors at the convention of the American Railway Association at Atlantic City in June were the following: Bastian-Blessing Company, Bird-Archer Company, Carbic Manufacturing Company, Carbo-Hydrogen Company, Electric Arc Cutting & Welding Company, Giest Manufacturing Company, General Electric Company, Gibb Instrument Company, Hauck Manufacturing Company, King Optical Company, Lincoln Electric Company, Mahr Manufacturing Company, K-G Welding & Cutting Company, Metal & Thermit Corporation, National Carbon Company, Oxweld Railroad Service Company, Page Steel & Wire Company, Transportation Engineering Corporation, U. S. Light & Heat Corporation, Wilson Welder & Metals Company.



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containers with their normal amount of acetone and heating the containers in a sand bath until the pressure specified is reached.

Section Five—Accidents

Article Twenty-Three. In case of an explosion of containers causing the injury or death the head of the establishment shall immediately advise the Mayor of the Community (Maire de la Commune) who will in turn give notice to the Bureau of Mines or to the organization having authority to represent the Bureau of Mines.

The competent authority shall visit the scene of the accident with the least possible delay and draw up a report on the causes of the accident.

1. An official report on the observations made shall be forwarded to the Chief Engineer of the Bureau of Mines, who will forward a copy to the head of the establishment.

2. An official report shall be made to the Chief of Police of the Community with the consent of and through the offices of the Chief Engineer of the Bureau of Mines.

The fragments of the exploded container shall not be moved or altered nor shall repairs be carried out before an inspection is made by an engineer of the Bureau of Mines or an individual authorized by him.

Article Twenty-Four. The provisions of the present regulation shall be confirmed, supplemented and amended according to laws in force.

The President of the Committee
E. Deschars
The President of the Welding Institute
L. De Seynes

The Recorder
C. Simon

Note 1. No fusible plugs or safety discs, as they are known in this country, have been employed on valves used in France. The intent of the provision is believed to be to provide that a fusible seat is to be employed which will melt and release the gas. This instead of a separate fusible plug or safety disc opening.

Note 2. The reports and memoranda on which these figures are based may be obtained from the Chambre Syndicale de la Soudure Autogene, 104 Boulevard de Clichy, Paris, France.

THE CHICAGO LOCAL

Editor:

Please announce through the columns of the Engineer that Chicago Local Lodge No. 301 reached the one hundred mark in membership since May 1, and has opened a clearing house for the registration of welders and cutters needing employment, and for all employers needing welders, our purpose being to furnish the employer just the particular kind of a welder he may require for his particular line of work.

We also wish to state that we are accepting all A. F. of L. welders and cutters who are in good standing with their locals without initiation fee, on payment only of small monthly dues, and are taking in both union and non-union welders from all states until such time as we are able to organize them into local lodges of their own, when a transfer card will be issued to their own state lodges. All welders and cutters not affiliated with the federation will be accepted in our Chicago local until further notice at $5 entrance fee, and $1 per monthly dues payable quarterly in advance. However when we receive our charter from the A. F. of L. our initiation, or entrance fee will be advanced to $25. Our regular meeting nights are the first and third Thursdays of each month, at No. 180 W. Washington St., Hall No. 201. Come up and get acquainted. We are the BEST fellows you ever met. Meet Us!

Sincerely and Fraternally Yours,
C. H. Knight,
Recording Secretary.

521 W. Jackson Blvd., Phone Wabash 6291. Chicago, Ill.

NEW SALES MANAGER FOR REGO WELDING AND CUTTING APPARATUS

The Bastian-Blessing Company, Chicago, manufacturers of the REGO line of welding and cutting equipment, announce the appointment of Mr. Frank R. Goehler as sales manager.

Mr. Goehler has had a very broad experience in the business world and since 1913 has been actively engaged in the welding and cutting line. He, for several years, was district manager of Pittsburgh for one of the leading manufacturers of oxy-acetylene equipment, and in April, 1918, organized

Frank R. Goehler.

The Weldcraft Equipment Company of Pittsburgh to handle REGO equipment in the state of Pennsylvania.

Mr. Goehler's new connection gives him an opportunity to broaden his scope, and his many friends in the oxy-acetylene line are very confident that he will "make good" in his usual style.

The Society of Naval Architects and Marine Engineers has available a printed supply of a paper entitled "The Application of Electric Welding to Ship Construction" by H. Jasper Cox. Copies of this paper may be obtained at twenty cents (20c) per copy by addressing the society at 29 West 39th St., New York, N. Y.

On page 58 of the June issue in an article entitled "Crystallization" two errors were made to which we call attention. As the article read, the statement was made that "steel is now entirely destroyed." It should have read "steel is not, however, entirely destroyed." The article also stated that an oxidizing flame is a neutral flame. It should have read that "an oxidizing flame is not a neutral flame."

CROSS HEAD WELDED WITH OXY-ACETYLENE PROCESS

Enclosed please note two photos of cast steel cross-head, No. 1 showing crack cut out for welding and No. 2 showing job finished.

Method of handling—Stood cross-head end as in photo, built fire brick furnace around, allowing about 4-inch space for fire. Preheated with charcoal to red heat; made weld from each side and finished on top, then covered up with asbestos and left cool in furnace over night.

This heat treatment is good for the cross-head and allows weld to cool without any strain. J. E. Histed.

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To be used where extreme toughness and medium hardness are desired.

No. 5—MEDIUM CARBON STEEL
To be used for work where limited abrasive wear is encountered.

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We wish to present an ALUMINUM SOLDER that is entirely new to the welding fraternity.
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Aluminum welding has always been a very difficult operation, and one that required the highest experience known in the business, but today by the aid of our famous WELDIT Aluminum Solder a novice or tinner can make an aluminum job far superior to anything ever attempted heretofore. There is no long drawn out set of instructions to go with this solder. All that we ask is that you warm up the casting pretty well with the torch, then clean the Aluminum crank case or sheet thoroughly and rub the solder into the broken part with a large size soldering iron, very hot. It is practically impossible to break the joint and will hold far better than the average aluminum weld. It is generally the simple mechanical operations that are the best, and this is unquestionably a specific case.
Do not fail to send for a trial pound of this material. No samples furnished free. We will not ship C. O. D. We guarantee this to be superior to anything ever shown, or your money will be refunded upon receipt of returned solder.

Price $2.50 per pound

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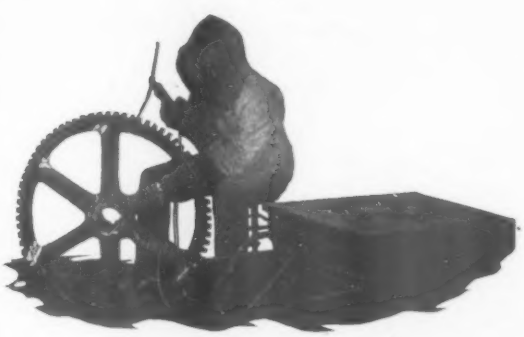

Bulletin 104

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LOW FIRST COST
PORTABILITY (Weight 265 Lbs.)
USES ANY TYPE OF ELECTRODES

Our Flux Coated "NEWARC" Electrodes make perfect welds. Ask for information—it will pay you.

Electric Arc Cutting & Welding Co., - Newark, N. J.

Campbell's "Oxy-Acetylene" Welding Manual

By Lieutenant Lorn Campbell, Jr.
Ordnance Corps, U. S. A.

Lieut. Campbell organized and conducted the Army Welding School at Peoria, Ill. His new manual is based on his experience there, in training soldier welders. 154 pages, 89 illustrations, bound in cloth, $1.25.

THE WELDING ENGINEER
Chicago, Ill.
608 S. Dearborn St.,

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A WORM FLANGE

Editor. Concerning Mr. John J. Foley's criticism in this month's issue of your magazine, on the topic, welding a worn drive wheel flange, page 26, March, 1920, issue. This reminds me of the brainless yop who says it can't be done, but is constantly being interrupted by someone doing it. Welding a worn flange on a drive wheel to my sense of ability is a very easy job and should be very serviceable providing, of course, it is done right. I myself have been very successful welding flanges on drive wheels. True enough the tire will expand considerably if the operator heats the whole tire but who in the world would heat the whole tire, unless Mr. Foley would? If the operator is quite handy with the torch, very little of the tire he would heat, as he should understand that he is to weld the flange not the tire and direct his flame to the flange only. Placing a soppy wet rag, or wet asbestos along the tire, constantly rewetting same, and cooling the flange or shrinking not too fast as it may crack the flange as I have known of such cases. After the welding is completed and the tire cooled or shrunk the tire will be a little tighter than before owing to the rapid cooling or shrinkage. As to the side rods, I see no need of removing same, unless, of course, they may be in the operator's way. I certainly compliment the welder who did this particular job and hope the job is still in service so that some of the critics or knockers might wake up and learn something to their advantage as such knocks as Mr. Foley's are very bad for the welding trade. If I observe the photo right, I believe that the welder is welding in a downward movement, but as the saying is, every little welder has a movement all his own. I believe, however, that if he would start on the right side of the wheel and go up, it would be more advantageous on such jobs as I know building upwards on such jobs makes better and quicker welds which is quite essential. A little borax will help the fusion and lessen oxide. Welding downwards, I believe, some of the melting metal flows over the cold surface and leaves a porus weld. Will Mr. Foley try this method once and publish results?

M. T. Quigley, 34 Elm St.,
West Carrollton, Ohio.

WELDING IN CUBA.

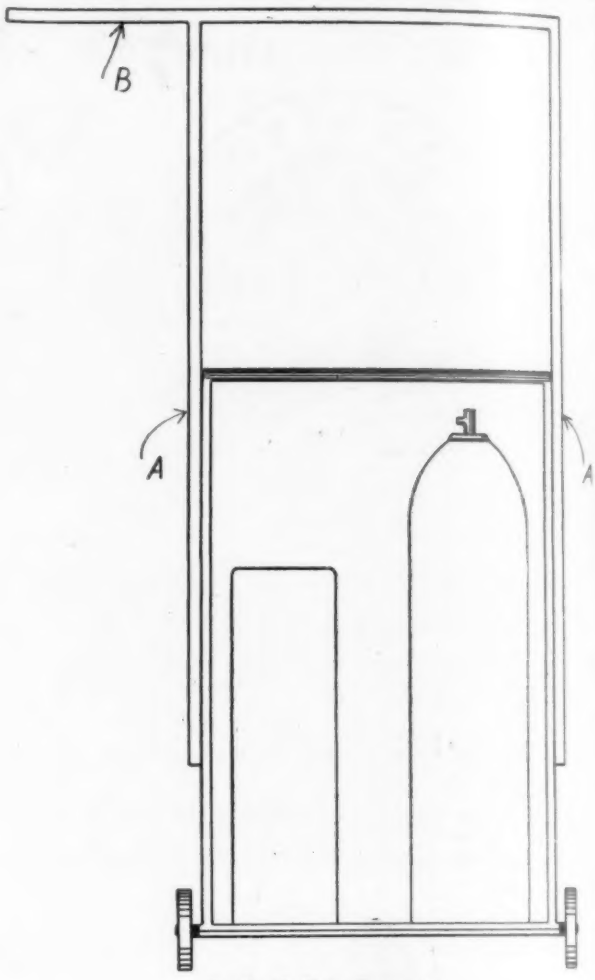
Editor:—An unsigned article on "Welding in Cuba" appeared in your May issue. This article is a bit misleading as it does not tell the whole truth regarding conditions here. I have already received a letter from one of my welder friends in the States who contemplated coming down here but appears to be scared out by this article. The main things I take exception to is the statement that it is extremely hot for welders all the year around, the pay here is much less than in the U. S. A. and living expenses about triple.

As to the heat, the only hot place I found down here was on the inside of a locomotive firebox and that's a hot place to weld anywhere in the world. Aside from that I have found the weather delightful in the six months that I have been here. As to pay, native mechanics do not get as high a rate of pay as mechanics do in the States, however, good men coming down here from the States do not have to put themselves on the level of the native mechanic as many concerns are desirous of getting a good American welder capable of taking charge of their welding department and they are willing to pay well for said services and once a man learns the language here, his opportunities are greatly increased. As to living expenses they are higher than in the States but far from being triple and once a man gets on to the ropes here, he can get along quite nicely.

CUBAN AIR REDUCTION CORPORATION.
E. R. Lindsey,
Service Department.

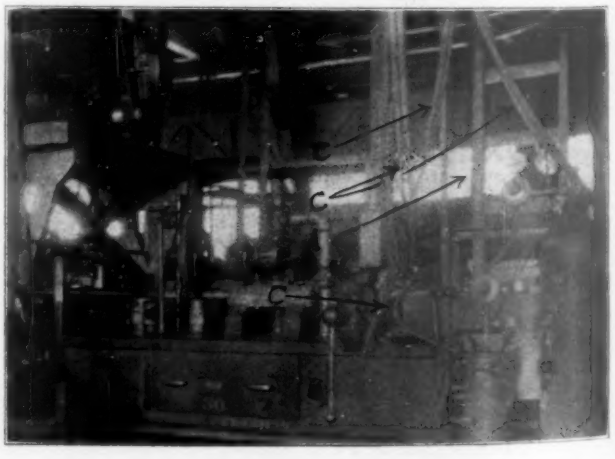
OVERHEAD SUPPORT FOR HOSE ON WELDING OUTFIT.

In order to carry an usually long hose on a portable welding outfit, at the Associated Oil Company's repair plant at San Francisco, the foreman of the plant arranged an overhead support which carries the long hose, and keeps the same up out of the way.



Overhead Hose Support.

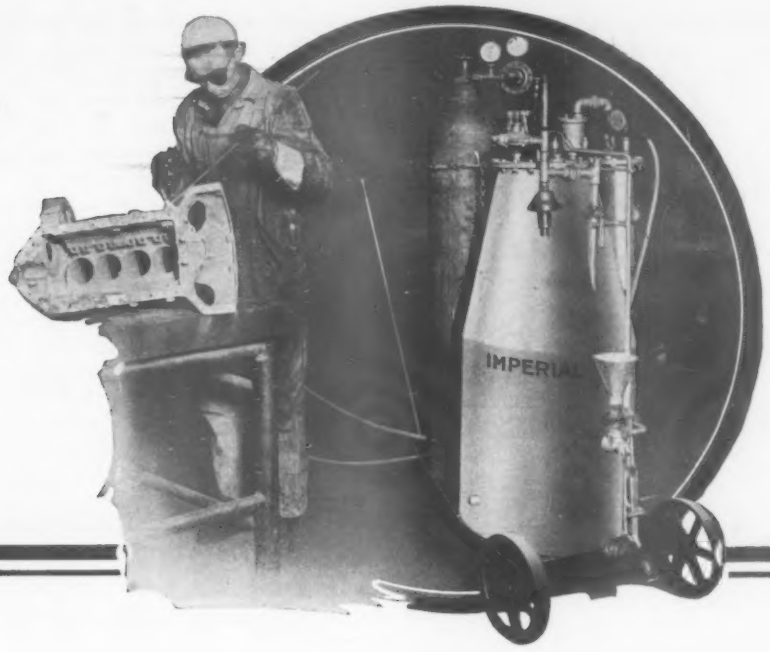
The support consists of two upright pieces A. A. which are tied



Overhead Hose Support.

securely to the side of the hand truck, and extending about four feet above the truck. A support B is bolted to the top of the upright pieces and extends about two feet over the side of the hand truck.

The hose is carried on the support B which keeps the same up



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out of the way, when the entire line of hose is not required to reach to the point where the welding device is to be used. This also carries the hose out of the way of the operator when the hand truck is being moved from one point in the shop to the other.

In the accompanying photo C. C. C. C. point to the long length of hose that is supported overhead.

This welding equipment is used in welding crank-cases, broken frames and cutting open large oil tanks for the purpose of making repairs to bulkheads. In one instance the equipment was taken to Merced to repair oil tanks at the oil station.

C. W. Geiger.

DISCUSSION OF PAPERS PRESENTED AT THE MASTER BOILER MAKERS' ASSOCIATION CONVENTION

At the opening of the Master Boiler Makers' Association convention the subject of firebox welding was brought up for discussion. No formal report had been prepared, so the subject was opened immediately to the floor.

Electric and Oxy-Acetylene Welding of Firebox Sheets and the Use of Welding in Locomotive Repair Work

Professor Alfred S. Kinsey, of the Stevens Institute of Technology: It was my good fortune to attend the meeting of the American Society of Mechanical Engineers at St. Louis recently. You know that that Society has a boiler code committee. It is that committee which controls the rules and regulations for the repair, and also the manufacture of boilers in the different states of the country. That is, the state boiler inspection boards usually adopt the rules of this boiler code committee.

Now the boiler code committee have been considering for some time the welding of boilers. At the St. Louis meeting they were petitoned by a large boiler manufacturing concern for the privilege of welding heating boilers, not to sustain a greater pressure than 15 pounds—in other words, do away with the riveting and make the whole boiler by welding. This matter is before the committee now, and while I cannot speak for it, the matter is receiving very favorable consideration for lower pressures.

Now you also know very likely of the American welding Society. The American Welding Society, realizing that its interests (and they are yours if you are interested in welding at all) and the interests of the boiler code committee of the American Society of Mechanical Engineers were the same in this matter, appointed a committee known as the boiler code conference committee, of which committee I have the honor to be chairman, to work in conjunction with a welding committee appointed by the boiler code committee of the American Society of Mechanical Engineers.

These committees have been in deliberation and have carefully considered some of these questions that interest you.

The boiler code committee has worked very slowly and carefully. They do not intend to make any rules to be unfair to any organization, or any company, or to any process. They are satisfied that welding has its good qualifications. They believe this so firmly that they have given, and encouraged the Hartford Steam Boiler Inspection and Insurance Company and the travelers' Insurance Company to give a rating to the old forge weld. Before we had an autogenous welding, forge welds were being made, some by machinery, but a great deal of the work by the sledge and the small hammer.

Now the old forge weld has been giving a rating of 52 per cent. This means that a vessel may be loaded up to 52 per cent of the strength of the metal. Is there anybody that can tell me the difference between a forge weld and an autogenous weld—how much may you load an autogenous weld? Is it 60 per cent, 75 per cent, or what? As a matter of fact there is no rating at all. It is not even one per cent. You can't get insurance on it.

Does that say that autogenous welding is no good?

Decidedly not. I have studied this matter from the start, back 15 years ago—not one kind of welding only, but four; the forge weld, the endothermic weld, the autogenous weld and the gas weld—and in our shops our men must not only know the theories of all of them but they must know how to make good welds, to the extent that you might expect a technical graduate to do that kind of work.

If autogenous welding has no rating, then you and I are to blame for that. I am an advocate of welding, I want to tell you, if it is done properly; and it is high time that societies like yours should put themselves on record as to what they believe is safe in autogenous welding.

There are only two ways of making a weld, in principle. One is by heating the metal up to the plastic state and forcing one mass into the other. You can do it with hammer blows, or by rolling. The other method is by melting the two ends and running the two masses together.

Now when the first came into existence there was no welding rod used. It was just simply the same material—the word autogenous meaning self-generating, or self-constituting.

Now we really ought to drop the word because a weld is not made without introducing a welding rod, and that brings in some other metal and so spoils the meaning of the word autogenous. Fusion welding fits the case better.

Now there are some people who believe, and I think most of you gentlemen believe that fusion welding can be done just as well as the old forge method—that is, as plastic welding—but I have met some who say no, you can never make a fusion weld as strong as a forged weld.

If the forged weld has a rating, let us try to get a standard of rating for fusion welding, so that it may at least be recognized and accepted up to a certain point.

I have gone over all the detailed data of A. G. Pack's (Chief of Bureau of Locomotive Inspection of the Interstate Commerce Commission) report that upset so many people, and I think we are likely to do that genetleman an injustice if we are not careful. He is not prejudiced against welding, though some think that he is. I have found him very considerate and very generous, not only in showing me the original data from which he drew his conculsions, but in giving me a lot of other facts.

If any of you gentlemen are responsbile for any of the welds that Mr. Pack has, I would suggest that you give your positions. They are the worst collection of welds I ever looked at. And if you have welders who are doing that kind of work, you ought to get rid of them, or at least put them in a school where they can learn welding. The conclusions drawn in the report are based on that kind of welding.

Now I do not think there is much of that welding going on at the present time. I know of at least one railroad system that is operating a welding school for its welders, and in a little while they will have established a rule that not a man will be allowed to handle a torch until he has gone through this school, passed examinations and satisfied them that he really is a welder.

It has been my privilege to go around the country a great deal and see what kind of welding is going on, and I have seen some remarkably fine work.

What are you going to do about the subject of firebox welding? I believe if you put the work in the hands of men who really know how to weld, you can make just as good a weld as any riveted joint. That is my candid judgment as an engineer after investigating this thing carefully.

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CONTENTS

Electric Welding Processes—Electric Resistance Butt-Welding Special Butt-Welding Machines and Processes—Electric Spot-Welding—Seam-Welding and Riveting—Percussion Welding—Electric Soldering—Principles of Electric Arc Welding—Applications of Electric Arc Welding—Welding Transformer Tanks by Electric Arc.

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so on, the grains are all flat-sided, with at least four sides—some have as many as eight sides. These flat sides touch one against the other, which is according to the law, which in physics we call cohesion.

In the case of one metal we have, I can destroy the law of cohesion by bearing on it with my finger. This metal is mercury, the liquid metal. Chrome steel, on the other hand, requires an enormous pressure to destroy the cohesion. I can take a torch, however, and reduce that law of cohesion until it is almost gone. At this point I must stop, for if I go on the law of cohesion will be entirely destroyed and the air will get in between the grains.

The air that we breathe contains both oxygen and hydrogen, and both of these are bad for the weld. When it gets in, it forms a separation film that almost completely destroys the law of cohesion. Then we say the weld is oxidized. If you want a good weld, do not heat it to this point and so keep out the oxide film. When you have heated metal to the molten state and allowed it to cool, a casting results. If you allow the metal to get cold after you have made your weld, heat it again and permit it to cool gradually, so the cohesion between grains will be stronger and the grains will come closer and closer together. There are two rules you should follow after welding: refine the grain so it will come back to its original size and keep its original strength, and be sure to anneal.

Now the fact of the matter is that the American Society of Mechanical Engineers will very likely establish a rule that will compel you to anneal your welds and steel after this, so it may be well to prepare yourselves for something of that kind.

Some people take the stand that an autogenously welded joint is weak because it is in the cast condition when finished, but if operations are carried out by competent welders and the welds are annealed, there is little doubt of the strength of the work. The American Society of Mechanical Engineers is considering very seriously this proposition: shall we license the welder, make him pass an examination and show that he is capable of doing good work? Or shall we license the man who employs him? Something of that kind will probably come up, so you ought to think about it.

C. P. Whalen, of the N. Y. C. R. R.: I would like to ask the professor one question. Which is the more efficient in a firebox and will give us the best service, the electric or the acetylene process?

Professor Kinsey: I am a professor at an engineering college. I am supposed to keep an unbiased mind on all of these subjects. It is not quite proper for me to say whether you ought to use the electric arc or the gas flame.

There is a great deal of money being spent by the big companies that are manufacturing devices for these two processes. They have their engineers, who will be glad to come to your plant and show you the best that can be done by their process. If I were in your place I would ask the electric arc apparatus manufacturers to send their best expert to show the best job that they think can be done in the welding of fireboxes; then have the gas people do the same thing, and draw your own conclusions.

Or better still, if you do not want to stop there, go on and have those welds cut out and sent to some independent laboratory where they will give you an unbiased report.

Carl A. Harper, Cincinnati: May I ask Professor Kinsey the best method of making an inspection of welds?

Professor Kinsey: A committee from the different societies is now very busy trying to determine a practical way of testing welds. It is a most difficult thing. First of all, let me say it is almost impossible to know what is inside a weld. We have tried all sorts of things, the vibration test, the tension test, which is the essential test; if you have any scleroscope for testing the hardness will tell very well whether the metal will stand machining. We are trying to kind of a vessel that has a breathing action, as in tanks, the ductility or bending qualities must be considered. Your think of other ways now that would be practical in shop work.

You gentlemen who have been welding fireboxes for many years, if you get a chance, rip apart one of your old welds to see what it is like inside. In fact, if you have many of these welds, whether made by electricity or gas, I will stand the expense of transportation to your plant and suggest to you ways of cutting into the weld, and if it is good work we all want to know it.

Safe-Ending of Boiler Tubes

There has been an impression abroad that the boiler code committee has taken a stand against the safe-ending of boiler tubes, so we have looked over the records to find if any ruling has ever been made against the welding of firetubes. We discovered that the association is on record against the safe-ending of boiler tubes for watertube boilers, but not against firetube welding. There is no rule against this practice so far as the boiler code of the American Society of Mechanical Engineers is concerned.

Charles Hempel, of the Union Pacific R. R.: There has been criticism relative to autogenous welding, both at this convention and at the last convention, and no doubt that criticism is just. I do not believe that it was offered with a view of condemning the autogenous process, but more for the moral effect that it would have, and I am satisfied that it has served its purpose. The question has been looked into very thoroughly since the criticism has been given. It has spurred us to a greater efficiency. The question of welding the safe-ends of flues has been agitated considerably by a number of large railroads.

First of all butt welding flues was tried. Butt welds will break from 25,000 to 29,000 pounds per square inch. Any of them could be considered absolutely safe for service. Inasmuch, however, as there was considerable criticism offered to the butt welding of flues, we naturally got busy to overcome that criticism.

The lap weld was then taken up, and I have yet to see the first lap-welded failure of a flue.

We have with the butt and lap together 600,000 electrically welded flues. I do not mean to say electric welded on the bead, but electric safe-ended. In that number we have had two service failures, as against about six to the thousand of the old hand method. Every flue that we have pulled has given us more than 100 per cent.

I do believe that if we will get down to business and get after this thing, that we won't have any criticism in the future.

I must frankly say that if the work continues as it has, and the government can show such defects as were mentioned in the annual report of the Bureau of Locomotive Inspection, we will have quite a job in having acetylene or electric welding officially recognized.

(At this point a paper on the electric arc process was read by Mr. Hempel.)

George Austin, Topeka, Kan., of the Santa Fe R. R.: The preceding speakers have practically covered all that I could say in the way of practical information or suggestions, except perhaps to describe briefly the Santa Fe methods as to determining the efficiency of the welders.

We realize that it is impossible to determine the efficiency of the weld as to its cohesion. It is not dificult at all where you have testing machines to pull the welds. In Santa Fe shops each month each welder makes a sample for test and sends it to the laboratory with his name stamped on it. If that test does not come above a certain per cent of efficiency that man is called in and must explain why he sent in the poor weld.

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I have no hesitation in making this statement, that according to our experience reliable welders can and do make welds in fireboxes or in other parts of boilers which are as strong as any single riveted seam, and a great deal stronger in most cases.

In reference to forge welded seams, I am going to ask Mr. Service, our welding supervisor, who keeps closer track of that than I do, to give you some figures as to the efficiency of our welding tests. And not only of recent welds, but of welds which have had perhaps four or more years of service—some of them not quite so much—taken on on account of sheet renewals or firebox renewals.

Our experience now leads us to believe that the autogenous weld can be compared favorably with forge welds.

We reinforce 20 per cent. Now understand about these tests, we do not plane the metal down to a smooth surface, for it is the weld we are testing. If we find it necessary to reinforce a weld 20 per cent to insure that we have an efficient weld, we add metal.

H. H. Service, Topeka, Kan., Supervisor of Welding, Santa Fe R. R.: It has been our practice on the Santa Fe to make a thorough investigation of all welds made by the welders. It is the practice to have them make at least one plate a month and send it in to our headquarters, where a disinterested party carries out the tensile tests. He does not know the man or where the work was done.

We also take the fireboxes that we have set out to be renewed and we cut out the plates and test them. We have a record of who welded a patch, where it was welded, and when. We have some that have been in the service 4½ years, and out of 29 specimens of these, 7 of them ran 71 per cent. Out of the 29 there were 9 straightened before we discovered that some of them had deteriorated somewhat. Where a patch was applied a small check an eighth of an inch deep had penetrated into the metal.

I go from point to point along the line to watch the work. I ask the men questions on metallurgy, how the machine is working, question them on various points about acetylene, as well as electric welding, to see if they understand it. If they do not, I try to explain to the best of my ability. By so doing we help the welder along.

If the welder has any questions he did not think of while I was there, he sometimes writes me. We try to get them interested, so they will learn the game.

George G. Fisher, Chicago, of the Belt R. R. of Chicago: I have a specimen of a superheater tube welded by acetylene. This specimen was put under a hydraulic press with a 5½-inch ram and smashed down under 45 tons pressure, and there was not even a fracture in it.

Now after all the discussion in this convention a year ago about the different kinds of welding and the stand some of our Interstate Commerce Inspectors took against it, I personally was not skeptical of flue welding, because I had been using it. In laboratory tests we have had excellent results with our welds.

Charles Hempel: The professor said he would be very willing to give his own personal opinion of the value of a weld. I will ask him to give his opinion on the electric weld. He said the acetylene was good, and I know it is good. I would like him to just give you his personal opinion of the electric weld.

Professor Kinsey: The two processes are entirely different, one a plastic weld, the other an autogenous weld. The former is made by electric compression, not by electric arc, which would be fusion welding. The latter is made by the gas flame, which is fusion welding, so it is not fair to compare the two for strength. The electric ought to be the weaker, because it is the plastic weld.

We know the great value of compression electric welding also. For example, the chain lengths, that used to be hand forged, are now made by the automatic welding machines by the plastic method of welding.

Mr. Hempel spoke of depreciation of 20 per cent in the strength of a weld after a locomotive had been a day or two in service. That is due almost entirely to the fatiguing of metals. Can you imagine a piece of metal getting tired? It does not actually do so, but it does go through a state of losing strength. The metal, because of the law of cohesion, might have a strength of 55,000 pounds per square inch at the start, but if oxidized the strength of the metal may be reduced to something like 45,000 or 50,000 pounds per square inch. All you have to do is send that joint out and let it get some vibrations. Does it encourage the flat surfaces of the grains to come together? Not at all. It discourages them.

Now the only way is to throw such a piece of oxidized metal in the furnace and burn out the foreign element. When the oxygen is present it is a case of poor welding. The vibration should strengthen the cohesion rather than decrease the strength, if you will leave the area in between the surfaces pure. There is an absolutely good engineering reason for this.

The President: Gentlemen, we have heard one side of the story. Now we want to hear the other. We claim that we do not know by the general appearance of it whether it is or whether it is not welded, and I know there are quite a number of other people in here who have had the same experience.

George W. Bennett, Albany, N. Y., District Inspector, Interstate Commerce Commission: I want to say that we are not against welding. Our interests are solely in protecting human life, and stopping snuffing them out day after day throughout the year.

Now any railroads that do any amount of welding are not making all good welds, and it is the extreme uncertainty of knowing when you have a good weld or a bad weld that we are fighting.

Now to show you that welds are failing, here are just a few notes that I took at one point from a railroad company's own work report. I will give the dates; it will show that the cases are recent:

March 2, two welds opened up in right side sheets, 12 inches long.

March 4, two welds opened up about 11 inches long, near center.

March 21, weld opened up about 9 inches long in throat sheet.

March 22, weld opened up 12 inches long, about 4 inches from throat sheet flange.

March 27, weld opened up in right side sheet 8 inches long; two welds in right back side sheets, 12 inches long.

March 28, weld opened up in sheet flange.

March 30, weld opened up 13 inches long.

And going further back in some of these locomotives I find that three or four weeks before that they have been sent to the repair shop to be welded.

After the sheets are in the boiler there is no way of testing the welds. Now I am only taking this side of it to explain to you that welds are failing, and there seems to be room for improvement along the lines of welding.

H. H. Service, Topeka, Kan., of the Santa Fe. R. R.: We will have to agree with Mr. Bennett on some things. I have a staybolt diagram here. It shows a crack here on the right side sheet in the original plate, and it extends 5 bolts high. One of the test specimens with that crack had been welded. No allowance was made for expansion and contraction. We gave it a rating of 80.01 per cent after it had been in service for a year.

Albert Stigmeier, Baltimore, Md., of the B. & O. R. R.: I think we should find out what is the cause of electrically welded flues cracking in from the butts. Is it due to electric welding, or is it due to the work being improperly done?

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CHAPTER VI.—MALLEABLE IRON, COPPER, BRASS, BRONZE.
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CHAPTER VII.—CARBON BURNING AND OTHER USES OF OXYGEN AND ACETYLENE.
Principle of Carbon Burning—Method of Operation—Lead Burning—Soldering—Case Hardening—Heating Uses.

CHAPTER VIII.—HOW TO FIGURE COST OF WELDING.
Oxygen Consumption—Dissolved Acetylene Consumption—Torch Consumption Test—Acetylene Generator Consumption—Cost Card—Conclusion.

Sent to any address Postpaid on receipt of $1.50 **THE WELDING ENGINEER** 608 So. Dearborn St. CHICAGO ILLINOIS

Hold on! What were you doing just then? Storing away that interesting bit of welding experience, or a photograph, perhaps? Don't do it? Give it to us. We want to show it to 5,000 other readers of The Welding Engineer (you're the fifty-one hundredth). If there are objectionable features to it, just leave it to the Editor (he studied surgery), cutting off and adding to is his hobby.

Another thing, when you work out a successful solution to a welding problem write us about it. Grammar and composition don't count—it's ideas we want. If a sketch would illustrate your job in good shape, just make a rough pencil sketch; our draughtsman will do the rest.

If the welding industry is to grow, you welders must pass along your experiences. We pay for them.

THE WELDING ENGINEER

608 S. DEARBORN ST., CHICAGO

If it cannot be settled I would like to have a committee appointed on this question, because it is coming up on every railroad, and it certainly is causing lots of trouble.

W. H. Simons, St. Paul, of the Chicago G. W. R. R.: With regard to this cracking of the electrically applied flues, I find we have considerable trouble, but it is confined to the superheater flues. The small flues do not crack. I wonder if it is on account of the copper being under the flue and causing some kind of foreign substance to form that will crack those welds? The small flues never crack. The big flues crack within 16 to 18 months after they have been welded.

Lewis Nicholas, Indianapolis, Ind., District Inspector, Intersate Commerce Commission: I will say that small ones crack as well as superheater. We have had them in only six months and they crack.

Charles P. Whalen, N. Y. C. R. R.: When it comes to different methods of welding, especially electric and acetylene, either can be done proficiently provided the operator is good. I claim that we can successfully weld flues, safe-end them, either way. In the past twelve months I have overhauled something like 35 to 40 superheater engines, and their is not a superheater flue in those engines but what has an acetylene welded safe-end on it, and I have not had a failure or complaint from any one of the engines since they have gone back into service.

The question has been asked, why do superheater flues cracks that are electrically welded. I have taken the pains in our hard water district to try to ascertain why they crack. There are two causes for it. If you are in a hard-water territory and you have an electrically welded flue and it shows a crack going through the flue hole, and that flue has never been prossered or worked in the past three or four months, you will see that there is a scale formation where the copper pin goes through the flue sheet. The flue not being worked allows no water to circulate around the joint. The fire becomes too strong and causes the metal to begin to crack. Scale is formed probably ⅛ inch thick, and in some cases if it has run very long it will be heavier. Having no water near the joint to cool it, the flue naturally cracks.

The same with the side cracks. Cracks form under the arch, where combustion takes place. In hard water districts a formation of scale will be found in the crotch. As a result, the engine's heat will cause the heads of your staybolts to loosen up, which will start the formation of a pin crack.

It works the same way with a superheater flue. It would, to my mind, be better if a flue were prossered, which operation cracks the scale and allows the water to get near the joint.

While I believe that there may be some cases in which the two methods of welding are not absolutely perfect, I do think that most welding troubles can be traced to an incompetent welder.

C. E. Elkins, Little Rock, Ark., of the M. P. R. R.: I want to say that flues can be electrically welded in the sheet. I do not know anything about safe-ending by the electric process, but they can be welded in the sheet so that they will hold. Superheater flues on our engines do not leak, and it is up to foremen to see that the work is properly prepared and properly applied. You cannot weld a flue if the copper is showing. You have got to have the flues properly pitted down. When you have that done and the work is clean, the flues will hold.

James P. Smith, Aberdeen, S. D., of the Milwaukee R. R.: We get engines right out of our back shops that have welded seams, the fire door welded to the back head, and I want to tell you, gentlemen, that they leak, and sometimes they do not make very many trips either until they leak. Now we all know that the fire door with the flange welded to the back head is one of the easiest weld there is to make, and I ask if you ever saw one leak that was put on with studs? Well now, men, they leak when they are welded. I have had them crack half way around, and I do not know whether it is an incompetent welder that is the cause of it or not.

Possibly welding is all right in a good water district. What I want to know, is it successful in bad water? We have water that runs about 67 incrustation grains to the gallon.

D. A. Lucas, Milwaukee, Wis., of the Prime Mfg. Co.: In my experience I have turned out side sheets in a welded condition, where possibly 10 or 12 inches would open up in the seam during the performance of the engine from one shopping to another. In other cases I have turned them out where it was impossible to detect any defect in the sheet during the performance from shopping to shopping.

I would like to know if there was ever a comparison in the failures in the firebox that we turn out at the present time with the original sheets.

Albert W. Novak, Minneapolis, of the Milwaukee R. R.: The locomotive that Mr. Sinclair had reference to at Aberdeen is the 2011. I happened to be at Aberdeen at the time, and I will admit that door hole broke half way around. The ends were just broken—in fact, against the back head—allowing so much mud and scale and incrusting heads to form in there that the door would not keep cool.

It was not reinforced, and I believe that is the only door hole I have run across in the last two years that opened up in that way. Now that was welded by a man who had only about three weeks' experience.

NEWS ITEMS

The Big Three Welding & Equipment Company, Broadway and Jennings, Forth Worth, Texas, is the name of the new company which has been organized to conduct a manufacturing, job welding and supply business in the southwest. One of those most active in the organization of the new company is Cyrus K. Ricket, formerly one of the partners of the U. S. Welding Company and Ben K. Smith, who has also been connected with the same company. A well equipped plant has been secured and the company is now doing business.

Mr. E. S. Hurd, formerly Assistant General Manager of the Arc Cutting & Welding Company, Newark, has become connected with the Gigg Instrument Company of Detroit. Mr. Hurd is a graduate of the Electrical Engineering Department of the University of Maine and has had a wide experience in electrical welding. He is also a charter member of the American Welding Society.

On April 26th the Hon. Judge Chas. B. Whitmer, Judge of the U. S. District Court of the Middle District of Pennsylvania granted an injunction directed to Anthony Walukiewicz, trading as the Wizard Cylinder & Repair Co. of Wilkes Barre, Pa., restraining them from repairing scored cylinders, thereby, again sustaining our patents.

The Torchweld Equipment Company of Chicago has issued a handsome new catalogue thoroughly describing Torchweld apparatus and supplies. A copy will be forwarded upon request.

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has published reprint No. 85 the title of which is "Analysis of Arc Welding Principles and Processes." Copy will be forwarded upon request.

Scored Cylinders

and cracked water jackets successfully repaired. Our factory nearest you will make these repairs on a 24-hour service basis.

Regrinding of cylinders that have been scored by wrist pins or through other causes is unnecessary. The Lawrence Patent Process fuses a silver-nickel alloy into the defects, making a quick, clean, permanent job without altering the bore of the cylinder. Same pistons and rings fit.

Cracked Water Jackets Are Also Made Permanently Good Thru This Same Process

A list of our factories and licensees is given below. There is one near you. Send your scored cylinders and cracked water jackets to the nearest plant. There we will insure you quick service and perfect results. Aside from the liberal arrangements we make with you, the money saving service you render your customers will help make you known as a concern that looks after their interests—and this is a business asset in itself.

We Guarantee All of Our Work.

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Milwaukee—18 Martin St.
Minneapolis—14 N. 9th St.
Newark—292 Halsey St.
New York City—355 W. 57th St.
Philadelphia—1601 Summer St.
Pittsburgh—5102 Baum Blvd.
San Francisco—116 Hyde St.

LICENSEES

Alamosa, Colo.—Sumner, Ginder & Teal.
Brookline, Mass.—Back Bay Welding Co., 17 Brookline Ave.
Bloomington, Ill.—Keiser-Vanleer Co., 505 N. Market St.
Burlington, Iowa—The Paul Gross Machine Shop, 212 Washington St.
Baltimore, Md.—Reus Bros. Co., 150 W. Mt. Royal Ave.
Bay City, Mich.—L. D. Sheets, 506 E. John St.
Birmingham, Ala.—W. T. Sanborn & Co., 1010 N. 19th St.
Bridgeport, Conn.—United Welding & Repair Co., 172 Elm St.
Bronx, N. Y.—Victor Iron Works, Inc., 1106 Brook Ave.
Cedar Rapids, Iowa—Otto J. Jirsa, 1328 L Street.
Columbus, Ohio—Central Ohio Welding Co., 200 E. Lynn St.
Corpus Christi, Tex.—Corpus Christi Boiler, Welding & Machine Works. Cor. Laguna and Chaporral St.
Denver, Colo.—Blanchette Welding Co., 149 South Broadway.
Dallas, Texas—Lawrence Process Co., 511 Main St.
Des Moines, Iowa—Bernhard & Turner Auto Co., 506 W. 7th St.
Davenport, Iowa—Rival Machine Co., 316 E. 3rd St.
Erie, Pa.—Lake Erie Welding & Spring Co., 338 W. 12th St.
Eustis, Fla.—M. Hopson.
Evansville, Ind.—The Lindenschmidt Co., Ingle St. between 1st and 2nd Aves.
Flandreau, S. D.—Amdahl Bros. Co.
Flint, Mich.—Ox Welding Company.
Fort Wayne, Ind.—Motor Truck Sales Co.
Grand Rapids, Mich.—Ox Welding Co., 75 Sheldon Ave.
Galesburg, Ill.—Galesburg Machine Works.
Hartford, Wis.—Kissel Motor Car Co.
Harrisburg, Pa.—Harrisburg Welding & Brazing Co., 94 S. Cameron St.
Hartford, Conn.—Charter Oak Machine Co., 438 Asylum St.
Houston, Tex.—United Motors Co., 614 Louisiana St.
Jacksonville, Fla.—Wm. Mock, Jr., 41 E. State St.
Kansas City, Mo.—General Auto Parts Co., 1621 Grand Ave.
Louisville, Ky.—Southern Motor Co., 615 S. 3rd St.
Lima, Ohio—Buckeye Welding & Repair Shop, 133 Water St.
Lincoln, Nebr.—Lincoln Motor Car Co., Cor. Q and 12th Sts.
Montrose, Colo.—Hartman Bros. Co.
Memphis, Tenn.—J. B. Cook Auto & Machine Co., 247 Poplar St.
Marion, Ohio—R. G. Wolfel Welding Co., 206 W. Church St.
New York City—Goodwin Welding Co., Inc.
New Haven, Conn.—New Haven Welding Co., 763 State St.
New Orleans, La.—Scored Cylinder Repair Works, 724 Julia St.
Portland, Me.—Portland Garage Co., 49 Cross St.
Pensacola, Fla.—East Hill Garage, 1501 E. Blunnt St.
Portland, Oregon—M. Otzen, 16th and Glisan Sts.
Pueblo, Colo.—Pueblo Carriage Co.
Richmond, Va.—F. D. Schluter Auto & Welding Co., 1009 W. Broad St.
Reno, Nev.—Central Auto & Machine Works, corner 5th and Sierra Sts.
Rochester, N. Y.—General Welding Works, 87 Cortland St.
Raleigh, N. C.—Republic Service Co., 108 S. Blount St.
St. Louis, Mo.—Scored Cylinder Repair Works, 325 Jefferson Ave., N.
Saginaw, Mich.—J. & M. Welding & Repair Co.
Salt Lake City, Utah—Karl Winter, 719 S. State St.
San Antonio, Texas—General Welding Co., 105 Villita St.
Springfield, Mass.—Hoag Welding Co., 31 E. Court St.
Springfield, Ill.—Romie Fields, Rear 317 S. 3rd St.
Seattle, Wash.—Motor Parts Co., Inc., 815 E. Pike St.
Sawyer, Wis.—F. J. Pies & Co.
Sioux Falls, S. D.—Schmidt & Son, 319 N. Main St.
Sioux Falls, Iowa—W. A. Carlson, 1110 Fifth St.
Scranton, Pa.—Scranton Welding Co., 321 Washington Ave.
Tacoma, Wash.—Lampson Welding Works.
Tampa, Fla.—R. G. Wood, 113 Water St.
Utica, N. Y.—Sherman Sales Co., Inc., 516 John St.
Warren, Ohio—Cooper's Storage Battery Service Co., 102 W. Market St.
Washington, D. C.—Day Welding Co., 43 Sumner Court, N. W.
Wichita Falls, Tex.—McFall Brothers.
Wilmington, Del.—J. A. Dillman, 308 Madison St.
Winchester, Va.—Valley Radiator & Welding Co.
Worcester, Mass.—Central Autogenous Welding Mfg. Co., 98 Union St.
Youngstown, Ohio—C. F. Erb, 722 Madison Ave.
Zanesville, Ohio—Chris. Brownfield, General Delivery.
Montreal, Canada—Pyke Motor & Yacht Co., 374 Notre Dame St.
Regina, Canada—Capitol Welding Shop, 1762 Osler St.
Toronto, Canada—Packard-Ontario Motor Car Co., Ltd., 18 Bloor St., E.
Windsor, Canada—H. B. Holden & Co., 41 Sandwich St.
British South Africa—Ed. Works, Port Elizabeth, Cape Colony.
Melbourne, Australia—Finlay Bros., 322 Elizabeth St.

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Wanted—Salesmen, Demonstrators, Welders and others meeting the welding trade to solicit subscriptions to *The Welding Engineer*, or furnish names of possible readers. When you put your friend or customer in touch with this publication you do him a real favor—make it possible for him to learn more about autogenous welding, liberal proposition. Write me now. Yours for welding, Mackenzie.

ATTENTION, WELDERS & GARAGEMEN

We can furnish you with a SCORED CYLINDER MATERIAL with complete instructions for applying the same at $4.00 per bar, experience not necessary, our flux does the trick. We are the Inventor of the Johnson Patented Engine Suport Bracket for Ford Automobiles, and used before as a prevention, or after braek occurs in crank case. Price $1.50 each. Wilkes-Barre Welding Co., Wilkes-Barre, Pa. Established 1910.

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to train and take charge of our new district offices. Must be experienced in demonstration of oxy-acetylene welding and cutting apparatus. Give full particulars with first letter.

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For Sale: Two 100-pound Davis Bournonville acetylene generators, $150 each; 1 20-pound Davis Bournonville acetylene generator, $20. Weldrite Co., 104 Hunter Avenue, Long Island City, N. Y. 4t-4-5-6

Superior Brazing Compound

A product of years of time and study. Over 98 per cent pure boron. Its use is not attended by deposit or scale. Acts as a superior flux and purifies the brazing spelter, causing spelter to flow evenly into every part of joint, without deposit, scale or enamel. A trial will convince the experienced welder of the merits of Superior Brazing Compound.

If your dealer cannot supply you, we will.

Standard Mfg. Co.
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For Sale Or Rent—One gasoline motor-driven Lincoln Electric Welding Unit connected with Air Compressor and 1,000 feet of hose for chipping and caulking, and 1,000 feet of wire cable, all mounted on a Five-Ton Truck, that can be taken to any dock or building for instant repair. This unit is in good condition and can be demonstrated at any time. EUG. BOURNONVILLE WELDING CO., 241-245 West Sixty-fourth Street, New York, N. Y.

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Address in confidence, stating age, experience and earning capacity.

Wanted at once—Several second-hand W. K. Prest-O-Lite cylinders. State best price for cash. Benj. J. Baldus, Holland, Mich. 1t—July.

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Increase your earning power by learning how to make the **fluxes** in your own shop. Write for prices on **formulas** today. American Flux Company, Box 153, Madison Square Station, New York City.

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For Sale—A 200 lb. Davis-Bournonville acetylene gas generator. In excellent condition. Will sell reasonably. For further particulars write the Belber Trunk & Bag Company, Philadelphia, Pa. 1t—July

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1/8" K-O PURE DRAWN TOBIN BRONZE, 36" long, per pound	66c
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They are our regular stock of rods, and we absolutely guarantee them to be of the highest quality. If they are not exactly as represented, you have the privilege of returning same, and your money will be refunded.

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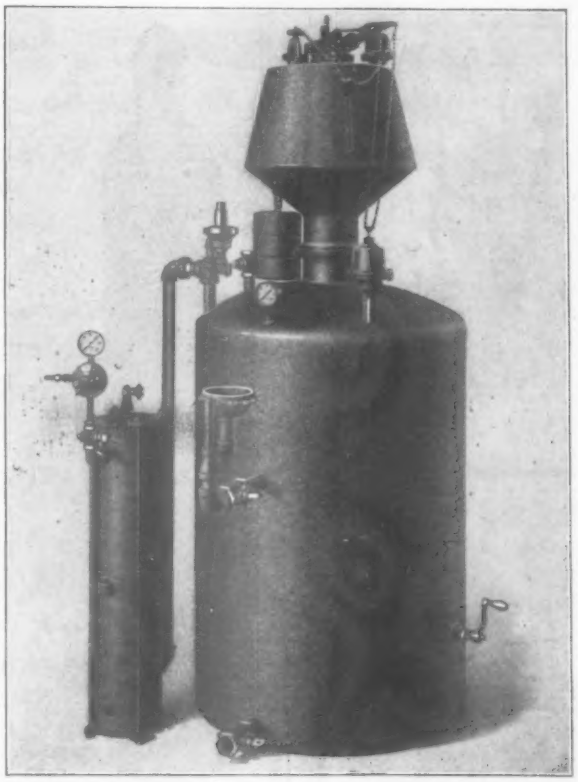
How many good-paying jobs do you actually sacrifice every month, on account of being without acetylene?

Why not purchase our KENTUCKY Generator and make your own?

You can manufacture it at about 1¼c per cubic foot with a KENTUCKY Generator.



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25 Pound Size	$215.00
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Wanted—High grade salesman and demonstrator of direct current arc welding equipment for New York state territory. Preference given man familiar with electric motor and generators. Address No. 23, THE WELDING ENGINEER. 2t—July, Aug.

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OXWELD ACETYLENE LOW PRESSURE DUPLEX GENERATOR, capacity two hundred cubic feet of gas per hour from each generator. Generating chambers can be operated independently of each other, allowing one to be in use while the other one is being recharged or repaired, or both generators can be operated together which doubles its capacity, as both generators discharge into the same gasometer.

This unit is in A-1 condition, having seen but a short period of service.

Price $700.00 net cash, F. O. B. Chicago. Machine can be inspected at our plant.

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The following Oxweld equipment, in first class condition. Purchased for Government work and not now needed:

1 20 cylinder oxygen manifold, less regulators (10 cylinders on each side.) Cost Price	$ 290.00
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Standard Tool Mfg. Co., Detroit, Mich.
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The Radiagraph is one of the D-B line of mechanically-operated cutting torches much used in shipyards, bridge works, boiler shops, and other plants that need portable equipment for cutting and beveling plate and structural steel, near the place of erection. The saving effected in transportation cost alone in some large plants, by avoiding the necessity of carrying large heavy plates to stationary machine tools for shaping, is an important item. The Radiagraph cuts to straight and circular lines, and the torch may be set at an angle for beveling the edges of boiler plates to the calking angle.

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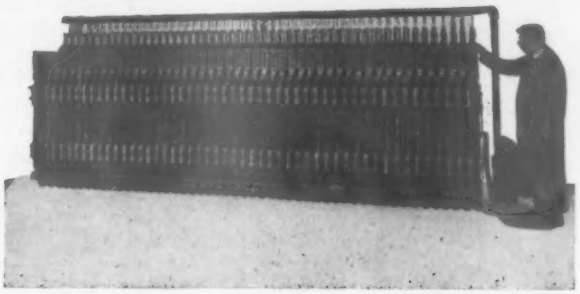

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MEMPHIS, TENN.

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ALLWELD

This is not intended to entirely replace aluminum welding, but a real aluminum solder is a most desirable asset in the welding shops. All detrimental characteristics of so called Aluminum Solder are eliminated. Write for sample.

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Welders and Employers

Please take notice that Chicago Local Lodge No. 301—Brotherhood of Gas & Electric Welders and Operators of America, has opened a clearing house for registration of all employers needing Welders and Cutters, and for all Welders wanting employment. It is our purpose to furnish to the employer just the particular kind of Welder he may require for his particular line of work. Employers and Welders Register your name and address with

C. H. KNIGHT, Rec.-Sec'y
Phone Wabash 6291 521 W. Jackson Blvd., Chicago.

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The Torch of a Thousand Uses.
Handiest Tool for any Shop.

Heat as you want it where you want it when you want it

Preheating Outfits for all requirements.

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Complete Welding and Cutting Equipments

Generators from 15 to 300 pounds capacity. Acetylene and Electric Welding materials. Fluxes for Cast Iron, Brass, Bronze, Aluminum and all other metals.

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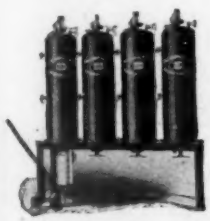

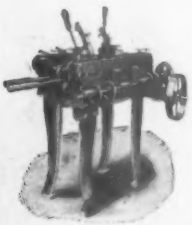

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